JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

AUGUST, 1832.

Suggested improvements in the Construction of Barker's Mill.

By James Whiteland.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

New York, June 5, 1832.

Sir,—The accompanying is a drawing* of what I consider an improved form of Dr. Barker's mill: you will very much oblige me by giving it, and the following description, a place in your journal.

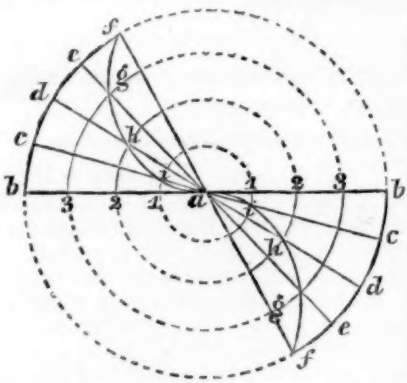
The mill is represented as working a little off the wall of a building. At the top of the drawing, and behind the bevel wheels, a cast iron wall-plate is shown, for fixing the pillow block into which the horizontal shaft (for working machinery inside of buildings, on which the upper bevel wheel is fastened,) turns. On the under side of this plate a cast iron trough, for conveying water into the mill, is fixed; the trough terminates in a cylinder just so small in diameter outside, as to work clear of the inside of the upright cylinders of the mill. This cylinder is so long, and the holes at bottom are so shaped as to admit the water with the velocity, and in the direction, of the water in the upright cylinder of the mill. Inside of the trough cylinder is a smaller cylinder through which the upright shaft works: at the top is a larger part for holding brasses for steadying the shaft. Under the trough cylinder is the cylinder of the mill, made of wood, and hooped as shown. At the bottom of this cylinder the arms of the mill are fixed; they are of a *curved form*. Behind the mill is a niche for the arms to work in. At the bottom of the niche is a circular trough

* See cut on page 76.

higher round its outer edge to receive the water after it has escaped from the mill: it is shown by the two ellipses at the bottom of the drawing. Below the mill is seen a square pit, for holding the step, into which the foot of the upright shaft works. The other parts of the drawing will be so easily understood as to make further description unnecessary.

The *curved form* of the arms is what constitutes the difference of this and Dr. Barker's plan of the mill. The curve is such, that the water will run from the centre to the extremity of the arms in a *straight line* when the machine is working: by this arrangement no centrifugal force is given to the water, as it has not received any rotatory motion from the arms; which it would have had, had the arms been straight.

The nature of the curve *f*, *g*, *h*, *i*, *a*, of the arms will be understood by the annexed diagram. Let *a* be the centre, and *a b* the distance to the centre of the upper stone from which the water flows; also let the concentric circles 1, 2, 3, divide this distance into equal parts; and take *b*, *f*, equal to the distance that the extremity of the arms would pass, in the time that a particle of water would flow from the centre *a*, to *b* the extremity of the arms. Divide *b*, *f*, into the same number of equal parts that the distance *a*, *b*, is divided, and from these points, let the lines *ca*, *da*, *ea*, be drawn to the centre. Now, since the motion of the water is uniform, and the motion of the arms uniform also, while the arms revolve from *f* to *e*, a particle of water leaving the centre at the time the arms were at *f*, shall have passed from *a* to 1; and the points *i* and 1 will coincide; also when the arms move from *f* to *d*, the water shall have passed from *a* to *h*, and the points *h* and 2 will coincide; and so for the other points: when the water arrives at 4, the point *g* in the arms will coincide with 3; and when the particle moves to the point *b*, the arms will have passed also to the same point, and *f* and *b* will coincide.



Since by this arrangement there is no additional motion given to the effluent water by centrifugal or any other force, till the velocity of the extremity of the arms becomes greater than the velocity of the water, all that we have to consider in estimating the power of this machine when working at any velocity less than that of the water, is the effect that a quantity of water, having the velocity that a body would acquire in falling from the top of the mill to the level of the jet holes, would produce, when working at different velocities.

The weight that will stop the mill must be equal to the weight of a column of water twice the height of the water in the mill on a base the sum of the areas of the pit holes. For it is evident that if the holes be shut up there will be a pressure on all sides equal to the weight of the column in the mill; let, now, the holes be opened, the pressure on the opposite side will remain as formerly, and the water being set in motion by an equal pressure, the reaction, (since action and reaction are equal and contrary,) will give another pressure equal to the former one, on the sides opposite the holes. Therefore these two forces will give a pressure equal to the weight of a column of water twice the height of the water in the mill, on a base equal in area to the sum of the areas of the pit holes.

When the mill is working at the velocity of the water, it will raise a weight, equal to the weight of a column of water, the same height as the water in the mill, on a base the sum of the areas of pit holes; and the effect will be a maximum, and equal to the whole power of the water. For it is evident that as the water flows with the same velocity as it did before, the force of reaction will remain as great as ever, and will just balance the above weight or one-half of the weight that will stop the mill. And the other force being caused by the pressure of the water on the areas opposite the holes, must cease when it has brought the velocity of the mill up to the velocity of the water, as this is as quick as the water can follow it. Therefore, with two forces, one to balance a weight equal to the pressure on the areas opposite to the holes, and the other to keep this weight in motion at the velocity of the water, an effect equal to the whole power of the water will be produced. For in the time that the water flows with the velocity that it left the mill, a length equal to the height of water in the mill, this quantity of water, or an equivalent weight, can be raised to the top of the mill.

The effect for the other velocities may be determined in the same way. When the velocity of the mill becomes greater than the velocity of the water, if there is no centrifugal force the weight that the mill will work with must be the force of reaction, minus the force required to carry the water round with the mill.

If the above theory is correct, I need say nothing of the advantages that this form of the machine has over the other forms, as, indeed, over every other water mill. By considering how much power remains in the water after it has escaped from the mill, when working at different velocities, the same results may be obtained; an additional proof of the correctness of the above theory: thus, when the mill is standing, the water escapes with its whole force and no effect is produced. When working at the velocity of the water the mill moves as quick as the water, and the water, after it has escaped, has no motion in any direction, but falls directly down. Now, since there is no power remaining in the water, its whole power must be spent in producing an effect equal to its power in keeping the mill and resistance in motion. The power when the mill is working at one-half, or any other velocity, may be determined in the same way. As the motion of the mill is just as quick as that of the water, the

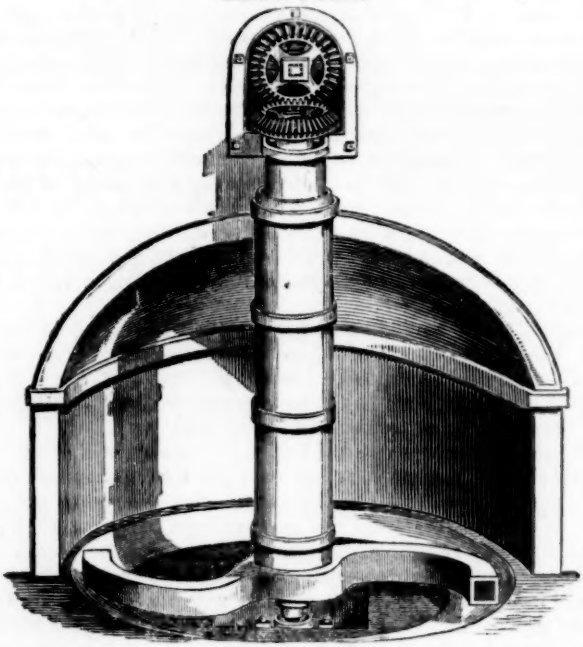
portion of the circumference *b*, *f*, must be taken equal to the length of the radius or arms, if the areas of the holes and arms are alike: if the holes be smaller than the arms, the portion *b*, *f*, must be longer in the same proportion, as the water moves slower along the radius.

A rotary steam engine might be made in this way by sending steam through a mill working inside of a condenser. The steam pipe might be connected to the steam wheel by a metallic packing. If the wheel was large in diameter, there would be very little friction, as it would require so small a pipe in proportion to the power of the engine. The power might be taken from the steam wheel, and the motion reduced by letting the axis of the wheel rest on friction rollers, and the power taken off the axis of the rollers by means of toothed wheels, or other rollers. Another method would be to force water or any other liquid through a machine of this sort by steam.

Yours, &c.

JAMES WHITELAND.

Barker's Mill.



FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on the Explosions of Steam Boilers. *By* JOHN D. WARD, *of Vergennes, Vermont.*

THE June No. of the Journal of the Institute contains a letter from Thos. Ewbank on the causes and means of preventing explo-

sions of steam boilers. In the course of his remarks he mentions a safety pipe (which is only a modification of the contrivance known among workmen by the name of "a feed head,") and gives an account of one on board the steam-boat M'Donough, on lake Champlain, which is inaccurate in some of its details.* As the engine was made by John D. Ward & Co. of Montreal, designed by myself, and built under my superintendence, I beg leave to set Mr. Ewbank right in the following particulars. The engine was built and set to work in 1828, and the safety pipe, or feed head, formed part of the original design, and was *not afterwards added;* its height was originally about thirteen feet, instead of twenty, and it was not intended that the engine should ever be worked with a greater pressure than four pounds per square inch; however, during the ensuing winter an ignorant engineman persuaded the proprietors of the boat that the boilers were sufficiently strong to bear a much greater pressure than had been used, and that it was only necessary to raise the feed head to enable him to double the pressure. His representations induced them to order the necessary pipes for that purpose from our foundry at a time when I was absent in Europe, and I learned with regret on my return that the engine was then at work with nearly twice the pressure of steam for which it was originally intended. The feed head is now about eighteen feet high, and may have been plugged up on some occasions; for the same ignorance and recklessness of consequences which led to raising it would lead to plugging it also; and both the one and the other having been done by the same person with impunity, his temerity will probably only end with his life.

I beg leave further to remark that the apparatus was neither expected nor intended to serve as a safety pipe any further than to prevent the engine man from using a greater pressure of steam than the engine was designed for, and they never can be made to supply the place of a safety valve for relieving a boiler from an extra pressure of steam without being of a size that will be found extremely inconvenient in practice, as every man will readily see who understands the subject.

With regard to the causes of explosions which have happened, and the means of preventing them in future, I think a great deal more ingenuity has been exercised than was called for by the difficulties of the case, especially in seeking for the causes of them. The real cause of nearly, if not quite, all the explosions that have happened, was a dangerous and unnecessary pressure of steam; amounting always to from fifteen to one hundred and fifty pounds, or upwards, per square inch.

The consequences which have resulted from using such pressure is a sufficient proof that it is dangerous; and that it is unnecessary is evident from the fact that a well made steam engine may be worked

* There appears to us to be a strict accordance between the facts stated by Mr. Ewbank, and those given by Mr. Ward: as we understand Mr. Ewbank, he says that the pipe *was* put to the boiler in 1828, *was* afterwards lengthened, and its height *is* now about twenty feet.—Com. Pub.

more economically with four pounds per inch than with a greater pressure. Hence if a certain amount of power is required on board a steam-boat it will be better to use a large engine and low pressure than a small engine and high pressure, because in the first place the low pressure is perfectly safe, and in the second place it is the cheapest. Perhaps the last position may be disputed, and it may also be said that the weight of the larger engines will be so great as to prevent the boats from having the great speed so desirable at the present day. To the first it may be replied that any addition to the first cost will be more than compensated by the subsequent saving in the cost of fuel. And to the second, that the weight of the fuel saved in a passage of any considerable length will be more than any extra weight required in the engine.

With regard to the means of preventing explosions, I think no new invention necessary unless it be some plan to prevent persons from meddling with what they do not understand; for if a steam engine is properly made, the boilers furnished with safety *valves* of sufficient dimensions, and weighted to rise when the pressure of steam is four pounds per inch, there can be no more danger in using it than in using any other machinery of equal magnitude. But to insure the proper construction and management of them some legal restraints must be imposed. And I see no reason why the man who builds steam engines for *passage boats*, and he also who manages them, should be exempt, any more than a physician or a lawyer, from giving good evidence, to competent judges, that they understand their business, and some pledge that they will make a right use of their knowledge.

Method of Tinning Cast Iron, &c. *By* Isaiah Lukens.

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Gentlemen,—Having frequently tried the following process for *tinning cast iron*, and having found it very easy of execution, and certain in its operation, I am induced to offer it for the benefit of those of your readers who may have occasion to use some process to effect the same purpose. This method is applicable to all sizes of castings.

The surface of the casting is first to be made perfectly clean, by turning, or scraping away the outside. Filing does not answer as well as turning or scraping.

Make an amalgam of tin with mercury, containing enough tin to form a soft solid, say of the consistence of butter at 60°.

Prepare a dilute solution of muriatic acid; the muriatic acid of the shops diluted with about an equal weight of water, will give an acid of convenient strength.

Heat the casting until so warm that on a further addition of heat it could not be held conveniently in the hand. Dip a clean linen rag into the dilute acid, and wash with it the surface of the casting where

it is to be tinned. Upon another piece of clean linen take up some of the amalgam, and pass it over the surface which has been wet by the acid.

A portion of the amalgam adheres; by rubbing the tin is precipitated upon the surface of the iron to which it is united, and the surface is tinned; after which the article should be immersed in a bath of melted tin and rosin to perfect the coating.

The explanation I take to be this. The diluted acid, aided by heat, acts upon the casting, forming a chloride of iron; when the amalgam is presented to this, the chlorine leaves the iron to combine with the mercury, and the iron and tin are precipitated in very intimate union if not in chemical combination. I do not mean to lay particular stress upon this explanation, the steps of the process are detailed just as I have frequently taken them.

It may not be amiss while writing to give an illustration of a method of making available for purposes of art the polish which nature presents in some melted solids. The polish of a clean surface of an alloy of melted tin and lead is very beautiful. Suppose it be desired to fix this upon a tube of copper or iron, as upon the iron spouts attached to tea kettles of tin. The tube is, if of copper, to be prepared in the usual way, and, if of iron, to be well tinned by the method just given, (or any equivalent one.)

Dip the tube into a vessel of a melted alloy of tin and lead, and allow it to remain until thoroughly heated. On withdrawing the tube the liquid metal runs down the surface. Pour rapidly *into* the tube cold water. The metal will immediately fix upon the outer surface, retaining the polish which it had when liquid.

Yours, &c.

ISAIAH LUKENS.

FRANKLIN INSTITUTE.

Note of the Committee on Explosions, acknowledging the receipt of a communication from John S. Williams, of Cincinnati, Ohio.

The committee on explosions acknowledge the receipt of the letter from Mr. Jno. S. Williams, requesting their consideration of a paper containing "some propositions and suggestions on the means of obviating or lessening the accidents incident to steam navigation," and inserted in the Journal of the Franklin Institute, vol. viii. p. 289. The typographical errors named will be corrected.

Explosions of Steam Boilers.

[Continued from p. 9.]

Supplement to the Communication of Thomas Ewbank, *to the Committee on Explosions.*

New York, June 23, 1832.

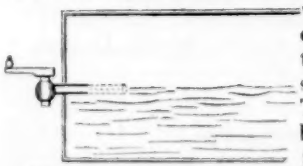
Gentlemen,—I take the liberty to submit the following remarks as supplementary to my second communication.* Want of time prevented me from including them in my last. It was my intention to test these, as well as certain other devices, by experiment, previous to troubling you with them, but other engagements have hitherto prevented the accomplishment of that purpose.

First, in relation to gauge cocks as indicators of the level of the water within a boiler.

The inaccuracy of the common gauge cock as a means of detecting the true height of the water in a boiler, arises chiefly from two causes: firstly, from the agitation of the water while steam is being withdrawn from the boiler to supply the engine, or through the safety valve: and secondly, from the current, or rush of steam, produced towards the aperture of a gauge cock when it is open; in consequence of which, the water, though previously at rest, and below the opening, is agitated and carried out through it.

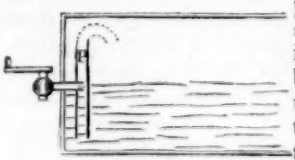
These defects are illustrated by Mr. Peale, in the eighth volume of the Journal of the Institute, page 147.

The last mentioned defect may be lessened by a perforated tube, five or six inches long, (see the accompanying cut,) attached to the end of the cock which is within the boiler. Such a tube would prevent the current from being concentrated towards the aperture of the cock, as the steam would enter it through the small openings in various directions. The small holes would, however, be liable to be filled up by dirt, &c. which so frequently chokes the common cock.



The next figure shows a method by which both the defects to which I have alluded as affecting the gauge cock, may be remedied.

The cock passes through the head of the boiler in the usual way, and is then united to a perpendicular pipe P, open at both ends, and about two or three inches in diameter. The lower end of the pipe is four or five inches below the surface of the water, and its upper end is carried as far above that level as may be convenient. This end may also be turned over, as represented by the dotted line, to prevent dirt, &c. from being thrown into it by the agitation of the

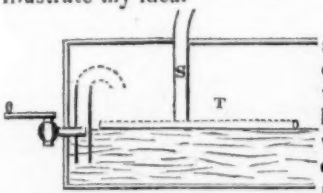


* Journal of Franklin Institute, page 1, vol. x.

water. When this cock is opened no current can be formed in the direction of its aperture, and the water in the tube P, (which will of course be at the general level of the water in the boiler,) will not be so subject to agitation. This cock will, moreover, not be so liable to be choaked as the common one.

It would appear that as the agitation of water in a boiler is caused by withdrawing the steam from it, this agitation might in some measure be prevented by a different mode of adapting the steam pipe to the boiler.

If the pipe could be so adapted as to allow the steam to press down towards the surface of the water, when entering the pipe, instead of (as in the usual way) ascending from the water, then the steam would have the same tendency to preserve the water at rest, which, by the present mode, it has to agitate it. The annexed figure will serve to illustrate my idea.

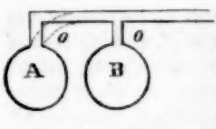


Suppose the steam pipe S to descend into the boiler until within two or three inches of the surface of the water, and then to be connected to the horizontal pipe T, which is perforated with small holes on its upper side only. The steam, as it enters this pipe, would have a direct tendency to preserve the water from rising, because the direction of the pressure would be then opposed to it. It may, perhaps, be supposed that in consequence of the position of the pipe with respect to the water, a portion of water will escape through the pipe with the steam, but if the steam in entering the pipe prevents the water from rising, I do not see how such an effect can be produced; and from the observations which I have made on the use of the float, (described in my last communication,) which in its first modification was liable to the same objection, I am inclined to believe that in this case there will be no such difficulty, and that the effect supposed can only take place by the careening of the boat, &c. Were the openings made in the lower side of the horizontal pipe, then, probably, as much water as steam would pass through them.

This mode of perforating on the top is applied to the gauge cock in the same figure, its end being closed, and the opening made on its upper side. This appears to me to be preferable to the usual opening in the end, as a less decrease of water will be detected by it. Besides, I do not see how the water (if previously below the opening,) can rise into it when the cock is opened for a short, or indeed for any, length of time, as is the case in the common gauge cock. (See Mr. Peale's account before referred to.)

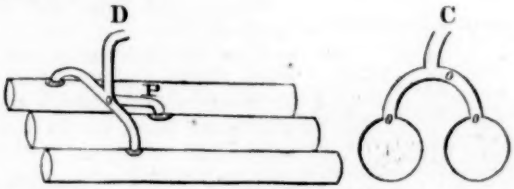
Second, in relation to the steam pipes of connected boilers.

The method of connecting steam pipes to boilers, where more than one is used, is frequently the cause of a more rapid consumption of water in one boiler than in another; and affords a further reason for feeding each boiler with water separately. Some boilers have their



steam pipes, (as in the cut,) connected to them at right angles: the consequence of this is that more steam escapes from B than from A when B is nearer the cylinder of the engine, and the steam has the same facility of escape from it as from A. Others, again, have the pipe from A curved, as represented by the dotted lines, and by this mode more steam is consumed from A than from B.

The proper mode would appear to be, to make the tubes *o*, *o*, of the same length, curvature, and diameter, before terminating in the steam pipe, as in the annexed figure, C. Where more than two connected boilers are used, the tubes should be arranged as shown in the figure D. The branch P, from the centre boiler, should be placed so far back of its junction with the others, as to make its length equal to that of each of these.



These remarks may very possibly be of little or no value, but as they are the result of observations made at different times, I have thought it right to submit them, with all their imperfections, to the enlightened judgment of the committee.

Very respectfully,
THOMAS EWBANK.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN FEBRUARY, 1832.

With Remarks and Exemplifications, by the Editor.

1. For a machine for *Washing and separating Gold from earthy matters;* Thomas Rives, Hall county, Georgia, February 3.

This machine operates upon the principle most commonly adopted in similar structures, presenting little novelty that we perceive, excepting in its being the first patent for a gold washing machine from Georgia, whilst all the other states through which the gold region extends, have previously sent their contributions to the patent office.

A long trough is to be made something like a horse trough, and this is to have bars of iron across it, which whilst they allow the finer particles of matter to pass between them, keep back the coarser. The earth to be washed is put into this trough, and water from a stream admitted at one end of it, by which the gold and other matter washed out, falls into a second trough standing at the other end. This

second trough has three or four partitions dividing it into separate compartments, which have agitators in the form of rakes, moving in them. The washings run through these several compartments, there being notches in the upper edges of the partitions for that purpose. The washing is further continued by putting the part containing the gold into another trough, suspended by ropes, having also a stream of water running into it, and being kept in constant agitation. A small water wheel, or any other adequate power, is employed to give motion to the respective parts.

The whole apparatus we think belongs to the infancy of the art, being but little calculated to save the finer particles of gold; a defect common to most of the machines which have been patented for the same purpose.

---

2. For a *Cheese Press;* John Holmes, Paris, Oxford county, Maine, February 6.

This is quite an old fashioned press, its action being dependent upon two eccentric wheels. There is a frame made with cheeks in the usual form. A shaft, hung on pivots, crosses the upper part of this frame, from cheek to cheek; upon this shaft there are two eccentric wheels, and upon the upper side of the follower two friction wheels, or rollers, upon which the eccentrics have their bearing. For the purpose of making continued pressure, weights may be hung upon a lever extending from a hole in the shaft carrying the eccentric wheels.

There is no claim made, nor indeed does the specification contain a description of the machine, dependence being placed upon the drawing only, which gives a full view of the instrument.

---

3. For an improvement in the mode of managing heat for warming rooms, called the *Fuel Saver and Economical House Warmer;* Robert B. Varden, city of Baltimore, February 6.

There are so many things in the plan here described which have been heretofore applied, and some of them patented, that we cannot tell precisely what is intended to be claimed as new, the patentee having presented the whole, and then informed us that what he claims "is the before described mode of managing heat, by which rooms are warmed, and cooking performed from the caloric that usually escapes with the smoke through the flue of the chimney."

The fire place is to be of cast iron, made in one piece, and set into the brick work so as to leave a hollow space behind the back and jambs. Into this hollow space air is to be admitted from the cellar, or from out of doors, whence, being heated by the fire, it is to pass through proper openings into the room. Above the fire place a hollow cylinder of iron is to cross the flue: cold air is to be admitted into this also, and in like manner, when warmed, is to escape into the room. Brass or other tubes are likewise to conduct heated air from chambers under the hearth, and into a room above.

The apparatus denominated the economical warmer operates in the

manner of the drum attached to stove pipes, and is to be fixed in an upper apartment, against the flue of the chimney. When it is used, a damper is made to close the flue, and cause the smoke and heated air to pass into, and through the warmer, which may be made of sheet metal, in any form, having cross tubes opening into the room to expose a larger surface to the heating process. A damper in the flue, or in the pipe above it, which returns into the chimney, serves to regulate the draft.

Besides the opening from the cellar admitting air behind the jambs, &c. there is another through the middle of the hearth, to supply a draft to the fire. Several appendages which we have not noticed are mentioned and figured; but the general plan has been described, and we leave it to those who have given attention to the different apparatus which have been devised for economising heat, to discover what there is of novelty in the principle, or in the arrangement of the foregoing *invention.*

---

4. For an improvement in the method of *Setting the teeth of Mill Saws;* Norman Urquhart, Madison county, Alabama, February 7.

The two lower teeth of a mill saw are to be set "one-quarter of an inch wide, and three-eighths of an inch from the edge of the tooth in towards the blade." When this has been done, a tooth is to be marked, the distance of which from the bottom of the saw is equal to four times the length of the crank; neither this tooth nor any of those above it are to be set, but the teeth between this and the lower teeth are to be set so that their points will just touch a straight edge laid on each side of the saw, from the marked to the wide set tooth at bottom. The set of the teeth will thus decrease regularly in width from the bottom to the marked or unset tooth.

The patentee says that when thus set a saw will cut with increased speed and power, whilst it will run perfectly free from all side friction.

---

5. For an improvement in the *Duster for cleaning Rags;* George Camel, Manchester, Hartford county, Connecticut, February 7.

The machine upon which this is an improvement was patented on the 27th of July, 1831, and is described in vol. ix. p. 60. The improvement "consists in surrounding the shaft of the duster for cleaning rags with a drum, and giving the drum and shaft a more rapid motion than the screen, so that the rags may be more easily cleaned." The instruction given for regulating this motion is so to apply the power, that whilst the shaft turns about seventy-five times in a minute, the duster shall turn about thirty-seven times, and both in the same direction.

---

6. For an improved *Tobacco Press;* George Booker, Richmond, Virginia, February 8.

The frame and screw of this press resemble, generally, those in common use, but the seat, or bed, upon which the keg, or box, is placed, instead of being firmly fixed to the cheeks of the frame, has two strong gudgeons passing through holes in the cheeks, and consequently admitting of its being inclined forward or backward. In pressing tobacco into kegs or boxes as heretofore practiced, much inconvenience has been experienced from their liability to burst in consequence of the great pressure, and the inadequate means pursued of bracing or supporting them. The principal part of the present invention consists of an apparatus for avoiding this difficulty. A cast iron case is made, of suitable form and size for containing the box, or keg. This iron case is made to open by a proper hinge joint, and has contrivances for holding it securely together. Plates of metal fill up the space which may exist between the keg or box and the cast iron case, and these are forced up by screws working through the latter, whilst the whole is so contrived as to be at once seated centrically under the screw, and thus to insure the regular action of the press. The turning of the bed piece facilitates the placing, removal, or examination of the article under pressure.

The whole apparatus is clearly described, well represented, and will certainly answer the purpose intended.

---

7. For a *Churn;* Jonathan H. Bruner, M'Kean, Licking county, Ohio, February 9.

We have had a truce with churns for some time past, and regret that in again introducing one to our readers, we are compelled to say that the character of novelty which is claimed for it, cannot be sustained. The body is that of the common vertical churn; it has a vertical shaft with pins, or dashers, projecting from it, which, as they revolve, pass between other pips, or dashers, projecting from the sides within the churn.

The shaft has a pinion on its upper end which is acted upon by a crown wheel, turned by means of its horizontal shaft and crank. The dashers, and the mode of operating, are perfectly familiar.

---

8. For a *Pump*, called by the patentees "a labour saving rotary gate purchase;" Levi B. Gitchell and Joseph Musser, Canton, Stark county, Ohio, February 11.

Although this contrivance is called labour saving, it is certainly one of those to which we might resort if we desired to gear a pump in such a way as would prevent its working with too much ease. It is proposed to use two barrels, constructed in the usual way; the *novelty* consisting in an old and long exploded mode of working the pistons. This is to be effected by means of a double rack and pinion acting upon each rod, and made in the way so frequently proposed for getting rid of the crank motion in the steam engine. There is a vertical frame having teeth upon each of its inner sides, and into these teeth, the leaves of a pinion are to take, the frame shifting from side to side as the piston is to be raised or lowered. There being

two pistons, there must be two such frames, and two pinions on the horizontal shaft by which they are to be worked.

In order *to increase the power*, a pinion, turned by a crank, gears into a cog wheel on the end of the shaft, and we are told that in this way the power may be increased in any degree; but it seems to be altogether forgotten that the friction is also increased, and the velocity diminished in the same proportion. The patentees seem to consider the whole apparatus as new, they having described it in all its parts, without making any claim.

---

9. For an improvement in the *Construction of the Dry Dock;* David Brown, city of New York, February 11.

A particular description is given of this dry dock, without any designation of those parts which are considered as new. As the patentee is a practical ship builder, he is undoubtedly aware of what has been heretofore done in this species of naval architecture, though not of the requirements of the patent law, which direct the patentee to distinguish his invention from every thing which has been before known or used.

This dry dock is to be built of timber, and is to be fastened between two piers, and sunk down so that its top shall be above the highest tides. A steam, or other engine, is to be used to free it from water. Its sides are to flare out about four inches to a foot, and there are to be diagonal braces within, from the bottom to the sides, which are to be so planked as to form steps, serving the purposes of the workmen, and lessening the capacity of the dock for containing water. The gates which enclose the vessel are to be about twenty-three feet from the outer end of the dock. The object of placing them there is to have double gates, one pair being near the end, that they may be closed whenever the inner or main gates required to be repaired.

The patentee designates the number and size of the main timbers to be used, and with this kind of description closes his specification; in these particulars we do not think it necessary to follow him, there not being any thing special, or peculiar, excepting what we have given above. The general plan is certainly not new, although the patentee could undoubtedly have pointed out many parts which are so.

---

10. For a *Washing Machine;* Silvanus Hathaway, Massillon, Stark county, Ohio, February 13.

The claim of the patentee will afford a tolerable idea of the nature of this invention; it is as follows:

"What I claim as my invention, and for which I ask a patent, is the general plan and arrangement of the machine as described, namely, the placing of a shaft horizontally, which shaft is to be turned by a crank, and has on it a fluted roller, which, by its revolution, causes a circular tub, or trough, to revolve upon its vertical axis. The bottom of said tub, or trough, being also fluted and elevated towards the centre so as to adapt it to the conical roller. I also claim the em-

ployment of a spiral spring, or of a weight, acting upon the outer end of the horizontal shaft to press it and its roller down, and at the same time to admit of its rising according to the varying thickness of the clothes between the two surfaces."

The only washing machine which bears any strong resemblance to this is one patented by John Hall, April 20, 1831, and described vol. viii. p. 163.

---

11. For an improvement in the *Machine for Pressing Flour, &c.;* Silvanus Hathaway, Massillon, Stark county, Ohio, February 13.

In this press the lever which forces down the follower upon the flour, is raised by means of an endless screw, working against the end of its longer arm. The concave nut in which the screw works does not embrace it, but is a segment of a female screw, so fixed that it can be thrown out of gear when the lever is raised to the required height. The claim is "to the employment of an endless screw upon a vertical shaft, which, by its revolution, raises the piece containing the segment of a female screw, and thus operates upon the packing lever in the way described; and to the manner of disengaging the said piece when required."

---

12. For a *Machine for Dressing or Picking Stone or Marble;* Clark Miller, jr., Williamsport, Lycoming county, Pennsylvania, February 14.

This machine is furnished with two or more picks, or chisels, which are placed on the end of a lever, hung like those of a tilt hammer, and like them raised by cams, or wipers. Springs are made to bear upon the levers, near to the picks, in order to quicken the blow. The whole machinery is fixed on a frame by which the operating parts can be shifted about. There is no claim.

---

13. For a process for *Bleaching Bay-berry Wax, or Bay-berry Tallow;* Benjamin Gomperts, city of New York, February 14.

Five hundred pounds of the wax, melted, are to have added to them a solution of chloride of lime, consisting of three hundred pounds of the chloride, and three hundred gallons of water. The whole is to be kept heated, and stirred until the wax is nearly white. A mixture of nine pounds of vitriol, and six quarts of water, is then poured in, which, it is said, serves to separate the water from the wax; the latter is then to be dipped off. The same process is to be repeated, after which five gallons of salt are to be added, and this, we are told, completes the separation of the water from the wax.

It appears to us that if the bleaching of this wax cannot be effected by a more economical process than the foregoing, it will be found too expensive to come into general use.

---

14. For a mode of *Fastening Handles on Hoes,* Shovels,

Axes, Hammers, &c. &c.; Reneer Dare, Greenwich, Cumberland county, New Jersey, February 14.

The hoe, or other tool, furnished with an eye, is to be passed on to the handle in the usual way. A piece of iron is to be forged with a shank and head, and to have a mortise through its shank to receive a key; the head is to be larger than the eye in the hoe, or other tool. The shank of this nail, or bolt, is to be let into the handle, so that the head of it may bear against the eye of the tool; a key is to be passed through a mortise in the handle and that in the inner end of the bolt, which thus confines the tool in its place. There must be a ferule driven on to the handle, reaching from the hoe to the mortise hole that the key may bear against it.

Did the patentee never see pitch forks fastened into handles by a key through a mortise in the shank and handle, a ferule being first driven on to the latter? This, it is true, makes but one half of his invention, there being no broad head required.

---

15. For a *Washing Machine;* William M'All, Hiram H. Higgins, and Reuben G. Rodgers; Athens, Limestone county, Alabama, February 15.

A trough with rollers on the bottom, forming together a hollow segment of a circle, has a convex segment formed of slats, suspended upon a spring above it, and between these two parts the clothes are to be rubbed until clean. After being washed they are to be passed between two wooden rollers, fourteen inches long and six in diameter; these are to squeeze out the water, and obviate the necessity of wringing. That the goodness of this invention may be known, the patentees shall speak for themselves; they say, "The foregoing described machine differs from all others in this, that the lower segment contains rollers and is stationary, the upper segment contains slats and is suspended from a spring. The spring is new, and also the cylinder press." But for the above assurance we should have doubted the novelty of some of the parts pointed out, and we still apprehend that the patentees have not seen the whole of the one hundred and fifty washing machines which have been patented in the United States, to say nothing of those in other countries.

---

16. For a *Shingle Sawing Machine;* Duncan M'Arthur and Thomas M'Kibbin, Urbanna, Champaign county, Ohio, February 15.

The general arrangement of this shingle machine resembles that of some others. The block is to be placed upon a carriage which is moved up to a circular saw by a rack and pinion. There is an apparatus for canting the block to give the shingles their proper slope. The parts designated as new are those by which particular movements are made, and these would require the drawings for their explanation, which, although they appear to be very well conceived, we do not think it necessary to give, as others equally good could be readily contrived by any skilful mechanician.

17. For an improvement in the *Still;* Jacob Miller, Lancaster township, Lancaster county, Pennsylvania, February 16.

This improvement consists in a particular arrangement of the head of the still, within which ascends a pipe or tube, about ten inches in diameter, up which the vapour is to pass; this tube reaches to about two thirds of the height of the head, it is covered with a cap, between which and the outside of the tube there is a space, through which the steam that rises is turned again downwards into the liquid, into which the open end of the cap dips to the depth of about two inches. A small supply tube passes up through the head, and near to one side of it; its lower end dips into the liquid, and through this last tube a fresh supply of low wines may be poured in, and the tube is then to be corked up.

There is no claim made.

---

18. For an improvement in the *Percussion Gun Lock;* Israel J. Richardson, Palmyra, Wayne county, New York, February 17.

The specification of this patent covers upwards of twelve pages, and enters into a very minute description of the various parts of the lock, but a small portion of which, however, is shown in the drawing. An attempt is made to be minutely particular, but the writer has certainly 'darkened council with words,' without communicating knowledge. In this lock, percussion powder is to be used, as formerly, without caps, and there is some peculiarity in the mode of making the discharge. The chamber in which the powder is contained, is a box standing on the upper edge of the lock plate, and may be about one and a quarter inch in length. It is perforated from end to end, and two pins fit into these perforations, one passing in at each end. When the gun is to be discharged, these pieces are forced simultaneously in, and meet at the middle of the perforation, where they inflame the powder. One of them is forced in by a cock placed in the usual manner, and there is another lever, or cock, at the opposite end of the plate, to force in the other pin. A rod, or stirrup, extends from one of these cocks to the other, causing them to act simultaneously.

The patentee claims all the advantages arising from the use of a gun lock constructed on the principle specified by him, and the various modes of action which he has intended to describe; we apprehend, however, that he has not succeeded in giving such a description as shall enable a workman to understand his principle, or reduce it to practice.

It will not be expected that we should give an opinion of the goodness of an invention which we have confessed we do not understand; this lock may be superior to others now in use, but we see nothing to warrant the conclusion that it is so.

---

19. For an improvement in the *Mode of manufacturing Oil Cloths by machinery;* Deborah Powers, relict and administra-

trix of the inventor, William Powers, Lansingburg, Rensellaer county, New York, February 18.

The petition for this patent states that the petitioner has reason to believe that some person has surreptitiously obtained, or is about to obtain, letters patent for the machinery invented by her late husband; alluding probably to the patent granted to Otis Ferrin, of Lansingburg, and noticed at p. 323 of our last volume. The machinery here described is essentially the same with that of Mr. Ferrin, with the exception of the hopper, or trough, for containing the paint, which is not mentioned in the present patent, but it is stated that the size, oil, paint, or other material, to be spread upon the cloth, is to be poured upon it whilst stretched, and lying horizontally, and that as it is drawn through the machine, the gauge plate, or scraper, removes the superfluous material; and, in the course of from five to ten minutes, will leave a perfectly uniform covering upon a piece of cloth four yards in width, and thirty in length.

We hope that Mr. Ferrin has property enough to carry on his business to advantage by means of his machine, if he is the true and original inventor of it; or, if otherwise, to pay threefold damages to the fatherless children and the widow, if he has attempted to wrong them.

---

20. For an improvement in the mode of *Cutting out Visors of Leather, and other materials, for Caps and Hats;* John Hoskins, Roxbury, Norfolk county, Massachusetts, February 20.

The apparatus described in the specification of this patent is, in its general features, similar to that noticed at p. 43 of our last volume, as patented by George Demitt, on the 20th of July, 1831. This patent is referred to in the specification, and the cutter used by Demitt is spoken of as a thing long known and used. The present patentee claims only to have made an improvement on that apparatus, by which the stamping, or embossing, of a pattern upon the edge of the visor is effected at the same time with the cutting. For this purpose a stamping tool, properly engraved, is fixed within the cutter, fitting close up to it, and standing sufficiently back from the cutting edge to allow the operation to be completed. This stamping apparatus is made adjustable to adapt it to leather of different thicknesses.

The claim is to that construction of the apparatus which enables it to cut, stamp, and deliver the visor at one operation.

---

21. For an improvement in the mode of constructing the *Steam Engine;* Stacy Costil, city of Philadelphia, February 20.

The cylinder of this engine is to vibrate on trunnions at its centre, and the piston rod is to be passed through a stuffing box at each of its ends. There are openings for the admission and discharge of steam, at each end of the cylinder, and faced plates forming the valve seats, which are in the same vertical plane with a cross section of one of the trunnions. There are no steam ways cast on the cylinder, the steam being let on and off directly through these open-

ings on the faced plate. The stationary valve against which the faced plates vibrate, is a flat hoop, concentric with the trunnions, and sufficiently large in diameter to extend from end to end of the cylinder, and to cover the valve seats. This flat hoop is cast hollow, for steam ways, each hollow forming nearly a semicircle, but with stops between them to prevent their communicating with each other. On that face of the hoop which fits on to the fore plates there are four openings, two to each face plate, serving to let the steam on and off at each vibration. Steam, and eduction pipes, enter at the other, or outer side, of the hoop. This hoop is held up against the valve seats by a bar of iron which crosses it, and which is borne up by a screw. The claim is to the "holding the valve against the cylinder by mechanical power, the valve being stationary, the disuse of the steam chest, and the consequent simplicity of the whole arrangement."

There is no small resemblance between the action of this valve and that described by Mr. Halloway at p. 43, under the name of the wing gudgeon valve. In that, the openings are near to the trunnions, in this, the fore valve is extended so as to carry the openings to the ends of the cylinder: and what is a little singular, both these patentees make one of their claims to consist in "the simplicity of the whole," which simplicity is rather an unpatentable article.

---

22. For an improvement in the *Machine for weighing heavy bodies;* Erastus and Thaddeus Fairbanks, St. Johnsbury, Caledonia county, Vermont, February 21.

The patent above alluded to is taken for an improvement on the weighing machine patented by the same gentlemen on the 13th of June, 1831. In speaking of that machine we observed that the general principle upon which it operated was the same with those which have been many years in use in England, and also in this country. There was some difference in the arrangement of the levers upon which the platform rests, and the patentees have since improved that arrangement, and made it the subject of a new patent.

Articles of this description require engravings for their illustration, there being but few persons who would clearly comprehend a mere verbal description.

---

23. For a *Fanning Mill for cleaning Grain;* Peter Prine and Lott Huestis, Auburn, Cayuga county, New York, February 23.

This fanning mill has the usual appendages of such machines, and it would be difficult to tell in what it differs from some of those which have been already patented; this difficulty seems to have been felt by the patentees as well as by ourselves, for they have neglected to say any thing upon the point, and the instrument looks so much like its predecessors, as to lay no visible claim to originality. We suppose, however, that as there are two patentees, there must be at least two points of novelty.

24. For a *Portable Horse Power;* James K. Cory, Bethel, Clark county, Ohio, February 27.

We do not know why this is called a portable horse power, as it is not made locomotive. In its construction there is little, if any, novelty, it being the common mill in which a horse by walking round turns a vertical shaft, carrying a horizontal cog wheel. There are ratchet wheels to prevent a sudden check, by the stopping, or backing, of the horse; particular directions are also given relative to the size of the respective parts, and the materials of which they should be made. There being no claim, we are not aware of the points upon which the patentee relies to sustain his exclusive right, and we do not perceive any part which we should not feel free to use without thinking of interfering with the invention of any one living.

---

25. For a *Cane Rifle;* being an improvement on rifles and guns; Roger Newton Lambert, Repton, Worcester county, Massachusetts, February 27.

Our readers are aware that guns, or rifles, in canes, are not new, but of course ingenuity may devise many novel modes of arranging the parts of such an instrument; that before us exhibits much skill, but still we think the instrument itself, however made, will never supersede the sportsman's gun, or rifle; and that for defence and offence, but few need it, and but few, therefore, ought to carry it. A truce, however, with moralizing; this belongs not to our present office, which is to tell how things are made, and not to assign moral reasons why they ought not to be used. As in many other cases, however, we cannot readily describe the peculiar arrangements of this cane rifle, although one point may be noticed which will be easily comprehended. The head of the cane draws back, so as to expose the lock, and then bends down upon a joint, assuming a form something like the butt of a gunstock. This is claimed, as is also the sliding of the barrel within the cane, for the purpose of retaining a cap over the muzzle, and the motion by which the cap, at the ferule end, is thrown off, when the piece is to be discharged.

---

26. For a *Card to be used in manufacturing Water Proof Hats,* Richard Mills, city of Baltimore, February 27.

This invention is described as a felting formed in the usual way, and then stiffened with a composition consisting of "the whites of hen's, geese, turkey's, duck's, and Guinea fowl's eggs, mixed with oyster shell and stone lime, being composed of half of each." This felt then becomes the foundation for a card, to form which it is stuck with teeth, and nailed upon a board. We are told that it is then called a "hot-water-proof-raising-card, used in the manufacture of water proof hats."

There is certainly something rather queer in this description; the eggs of so many different fowls, and two different kinds of lime are prescribed; perhaps the patentee knows the *why,* although he has not given the *because* to us. Should the Guinea fowl's eggs be omitted,

will the cookery be spoiled? and if not, would the rights of the patentee be infringed by using a composition without it?

---

27. For a *Compound Lever Balance;* Jared B. Wetmore, Rush, Monroe county, New York, February 27.

The instrument here patented is merely two combined steelyards; the specification does not even describe them, but descants upon the great power and utility of such an apparatus. Were it not for the drawing, therefore, we should have had but little idea of the form of this *very new* and useful machine. It is not the first time that we have called the attention of our readers to a patent for combined steelyards, and judging by the general course of things, it will not be the last, unless our career should prove to be a very brief one. The patentee has not claimed the particular arrangement of the instrument exhibited by him in his drawing; and where there is nothing new in the principle of, or the mode of action, in a machine, any claim made must be to some special, or particular, novelty of arrangement.

---

28. For an improvement in the *Bark Machine;* James T. Gifford, Veteran, Tioga county, New York, February 27.

This machine is intended to cut bark instead of grinding it as is usually done. There is a circular cast iron plate, of suitable diameter, the surfaces of which are flat. In its centre a spindle is fixed, as this plate is the runner. Six or more slits, or openings, are made through this plate, extending from within two or three inches of its periphery towards the centre. Knives, or cutters, are fixed in the slits, and project above the surface of the plate, in a degree proportioned to the intended fineness of the bark, which as it is cut is to pass through the slots in which the knives are contained. This plate is to be placed within a suitable frame, with the lower end of the spindle resting on a step, and what the patentee calls a bar circle is placed immediately above the runner, so close as just to allow the knives to revolve under it. The bar circle has an appearance something like the framing of a circular window, forming a lattice work of cast iron, the outer rim of which is of the diameter of the runner; it has a small inner circle forming an eye, through which the spindle passes. A third circle, intermediate between the rim and the eye, but nearest to the latter, is also used; bars radiating from the centre, in the manner of spokes, join these several rims together, and serve as stops for the bark, against which the knives cut.

A tub, which forms the hopper, surrounds the whole; there are radiating partitions in this tub, corresponding with the bars of the bar circle, and these may be considered as a series of hoppers, which, in the drawing, amount to twelve in number.

The operation of the machine will be readily understood. There is no claim made, the whole arrangement probably being considered as specifically different from the cutting and grinding machines heretofore made.

29. For an improvement in the *Head Blocks of Saw Mills;* John Sinclair, Richland, Belmont county, Ohio, February 28. (See specification.)

---

30. For an improvement in the *Plough;* Samuel Ogle, Fredericktown, Frederick county, Maryland. Patent issued to his assignee Samuel Witherow, Gettysburg, Adams county, Pennsylvania, February 28.

This is said to be an improvement on the plough for which a patent was granted to said Ogle on the 9th of June, 1818. This patent was for using an iron landside with the cast iron mouldboard, which was cast separately, but attached to the mouldboard by screws, or otherwise. The improvement now claimed is the casting of the landside of greater height than formerly, at its fore part, so that it may reach, or enter into, the beam. This part is to be made sharp, to answer as a substitute for the common coulter.

There is a good drawing of the plough, but no written references, as required by law. Cast iron landsides are described in several patents; some in one piece with the mouldboard, and others attached by screws. The claimants, direct and indirect, to cast iron mouldboards and landsides are so numerous, that should the whole of them become entangled in litigation, their ploughs would prepare a fine harvest for the lawyers, whatever might be the case with the farmer.

---

31. For a *Windlass* for hoisting and lowering heavy weights, which the patentee denominates a "Winch and Gin; Ebenezer Allen, city of New York, February 29.

That this windlass is a very good one there is no room whatever to doubt. We cannot, however, go the whole length with the patentee, who avers that "by means of this apparatus, four men can hoist three tons weight; and three men can hoist more in less time than twelve men could do by any other method heretofore used."

We have said that this is a good machine, but those who have arrived at years of discretion have lived to little purpose if they have not learned that goodness and novelty are very distinct things; and indeed that whilst the latter lasts, the existence of the former may be too readily admitted. This machine, however, will not, in our opinion, be liable to any suspicion in consequence of its novelty; for under various forms, combinations, and modifications, it has had the test of long experience, and has fairly won its honours. This *winch and gin*, or *portable winch*, is in form and substance the common hoisting windlass, used for raising stones and other heavy bodies. A square frame is made which is the bed, or ground sill, of the machine; and from opposite sides of this, two uprights rise which are to support the axles, drums, or barrels, with the necessary wheels and pinions upon them, the gudgeons of which run in bearings in these uprights. In raising goods, a winch attached to the upper drum or barrel, is to be turned, and a pinion upon this takes into a wheel on the end of a second drum or barrel; to either of these a rope or chain may be ap-

plied for attaching the goods, and if still greater power is wanted, another barrel, and an extra wheel and pinion, may be employed.

When the goods are to be lowered, this is to be done with the common brake, an instrument known to every competent mechanist. This brake the patentee calls *a spring or friction band*, and describes it as a hoop of iron passing loosely round a cast iron wheel, and capable of being made to press forcibly thereon by means of a lever. When the machine is to be used for articles of enormous weight, a second brake is to be fixed upon another barrel.

We almost fear to copy the final averment and claim of the patentee, as where there are antipodes there must be a whole world between them. He says "this machine, and all its parts, and every method of using it as hereinbefore described, the subscriber and inventor claims as his invention, and he has had the satisfaction of seeing it practically tested and approved on board of many vessels sailing out of the ports of the United States, he accordingly hereunto subscribes his name."

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the head blocks of saw mills. Granted to JOHN SINCLAIR, *Richland, Belmont county, Ohio, February* 28, 1832.

To all whom it may concern, be it known, that I. John Sinclair, of Richland, in the county of Belmont, and state of Ohio, have made certain improvements in the head blocks of the ordinary saw mill, by which the log to be sawed is held, shifted, and gauged, and the boards delivered in a more advantageous way than has been hitherto done; and that the following is a full and exact description of my said invention, reference being had to a drawing deposited in the patent office, and making part of this specification.

The apparatus which I employ is to be fixed upon each of the head blocks, to hold and adjust each end of the log to be sawed; the description of that upon one, therefore, will serve equally well for the other.

The log is to be held down by a lever pressing upon its upper side, the long end of the lever projecting out behind the head blocks, and its short end holding the log. There is a plate, generally of iron, fixed upon the head block to serve as a support to the fulcrum of the lever, and as a ratchet to retain a pall by which the lever is held in its place. This plate is fastened to the head block, by screws, or otherwise, its plane is parallel to that of the saw, and it may stand about an inch from the centre of the block. Its height will be regulated by the height of the largest log to be sawed.

Near the inner edge, the plate is perforated with holes one above the other, through which the pin, serving as a fulcrum to the lever, is to pass, these holes allow the lever to be shifted to suit the height of the log. The lever has a long slot, or mortise, to admit the plate to

pass through it. The outer edge of the plate is notched in the manner of saw teeth, and forms the ratchet, before named. A pall, or catch, attached to the lever, falls into these notches. When the long end of the lever is raised, its short end holds the log firmly, the pall sustaining it in its place.

To gauge the thickness of the stuff, and also to keep the log in its vertical position, its face, after being slabbed, is forced up against two vertical cheeks, standing at such distance from the saw as the thickness of the stuff may require. These cheeks are fixed upon pieces which slide upon the head blocks, to admit of their being removed to any distance required. I usually fix them to fall back exactly in the manner of the dog which works on hinges, or joints, but in some cases this is unnecessary.

The log, as the boards are cut off, is to be forced up against these faces, and held there by means of a progressive, or travelling lever, contrived for that purpose. A bar of iron is to be bent in the middle, staple fashion, so that the two parts of the bar shall stand parallel to each other, and allow a space, say of one inch, more or less, between them. This, when bent, may be a little longer than half the length of the head block, but must be short enough to pass within the saw frame. Instead of one bar bent, it may consist of two bars, properly secured, so as to answer the same purpose. It is to be fixed upon the head block, one of the bars lying thereon and being secured thereto; its two ends butt against, or may be rivetted to, the plate which supports the first named lever. In the slot between these two bars the progressive or travelling lever works, generally about six inches above the bed of the log. The upper edge of the lower bar is notched to act as a ratchet into which the catches of the progressive lever are to fall. This last lever passes between the two bars; it is furnished with two palls or catches, which fall successively into the notches upon the bar, and cause it, when worked, to follow the log, its short or inner end bearing against the side thereof. The mode in which this is effected will be rendered obvious by the drawing before referred to.

As the boards are to be sawed completely off, the log will become too light to hold the moveable head block down, it is secured, therefore, to the carriage by bolts which pass through it, hook under the carriage, and tighten on the top, by a nut, or otherwise.

Where the situation of the mill admits of it, the boards are allowed to drop through, under the mill, as they are sawed off, a notch being cut into the stationary head block for that purpose; in this case a thin sliding bolt may pass through the block to support the board whilst being cut. When the board is not to fall through, the hinged braces, which have the cheeks on, are thrown back, the board then falls, and is removed.

What I claim as my invention in the before described machinery, is the manner in which the log is held in its place by means of the levers which press upon its upper side, acting upon the principle herein described; the manner in which the boards are gauged by forcing the log against the vertical cheeks before described; the construction of the progressive, or travelling, lever, which forces the log

up without the aid of a crow bar, or other usual means; and the plan for allowing the boards to fall through the head block.

ENGLISH PATENTS.

To J. De Burgh, *Marquis of Clanricarde, a patent for improvements in Fire Arms, and in the projectiles to be used therewith, was granted on the* 15*th of July*, 1831, *and the specification was enrolled on the* 14*th of January*, 1832.

The improvements above mentioned consist in a moveable receptacle termed a sliding breech, into which the charge or projectile is immediately put, instead of loading in the usual way at the muzzle of the fire arm; and in the employment of a solid cylinder of lead divided into several pieces instead of spherical bullets.

In the specification is given an example of the application of these improvements to a large kind of pistol. The handle, cock, and other mechanical movements employed to ignite the charge, are much the same as in other fire arms; the barrel is provided at its breech end with trunnions, which enter apertures made into two strong iron plates fixed on the sides of the stock of the pistol; and a cavity is left between the two plates next to the end of the barrel for the reception of the sliding breech, which is internally made cylindrical for receiving the charge, and externally adapted to fit into its recess; it has a touch hole and tube for the application of a percussion cap, and turns upon an axis at one end into an inclined position, and by a motion of the hand, similar to that of half cocking a common gun; the charge being now inserted, and the breech shut down, its orifice is brought to bear in an exact line with the interior end of the barrel. In order that these parts may be accurately and firmly connected, the exterior edge of the orifice of the breech, and the interior edge of the orifice of the barrel, are turned to cones of similar inclinations so as to fit concentrically; and they are brought into close contact by a transverse wedge situated at the back of the breech, which by the action of a simple lever of great mechanical energy, moved by the thumb and fore finger of the right hand, (somewhat similar to that used in shutting down the pan of a common fire-lock,) forces the breech into the end of the barrel, and thus prepares the arm for being discharged. The sliding motion of the breech is only through the space of from a quarter to three-eighths of an inch, and it is guided laterally by the side plates—above, by an overlapping plate—and below it is confined by a fixed screw which works through an aperture adapted to it. The wedge, therefore, causes the breech to slide and lock all fast; and to reload, the lever of the wedge is thrown back by the right hand, and the fore finger of the left hand then laying hold of a kind of trigger, draws the breech out of the barrel, when the

former is again turned up, and recharged with the projectile; which projectile is of the following description.

A solid cylinder of lead, about two and a half times the length of its diameter, is divided longitudinally by two cuts at right angles to each other, through its axis; and again by two other cuts transversely at equal distances from each other and from the extremities of the cylinder; thus producing twelve equal and similarly formed pieces, except that at one end of the cylinder a hole is made in the centre to receive some percussion powder. As the cutting of these pieces out of a solid cylinder of lead is attended with some difficulty, the patentee has constructed a mould for casting them of these forms. This mould is a tool consisting of three limbs or bars sliding over each other by being connected at one end to a common joint or centre. The cavities or moulds in each of these bars are short cylinders divided longitudinally as before mentioned by thin metallic partitions; so that by a tool of this kind the twelve separate pieces of the projectile are easily cast and cut off. This combination of pieces is then wrapped in paper with the requisite quantity of powder at one end to form the cartridge, which is made of suitable dimensions to fit the chamber of the sliding breech described. We should now state that the barrel of the pistol (or other arm) is made gradually to widen, laterally from the breech to the muzzle, where it assumes the form of an extremely long ellipsis, (its transverse axis being about three times that of the conjugate,) which will cause the pieces of lead to separate and spread laterally, so as to wound or destroy a great number of persons.

[*Reg. of Arts.*

To JEAN JACQUES JAQUIER *a patent for improvements in machinery for making paper, communicated to him by a foreigner, which he denominates Xeranothlipte, was granted on the* 31*st of August*, 1831, *and the specification was deposited on the* 29*th of February*, 1832.

M. JAQUIER prefaces the description of his machinery by stating, that in all the apparatus previously constructed for making machine, or endless paper, with the great wire lines, similar to those in laid paper (or that made in hand moulds,) the pressure given to the pulp to consolidate it, had the effect of cutting the paper through, or into ribands of the width of the spaces between the lines. With the view of obviating such a serious defect in this imitation of laid paper, M. Jaquier conducts the sheet of fresh pulp on the endless wire web over an extended series of horizontal rollers, whence it passes round the main cylinder without receiving any pressure; but during its extended journey to the main cylinder, it has acquired sufficient consolidation by constant drainage and the shaking of the machine, to be capable of bearing afterwards a slight degree of elastic pressure, which

is produced by a small roller under the main cylinder; this roller is covered with several folds of "nappy cloth," partly to prevent its taking the paper off the mould, and partly to confer elasticity and a greater uniformity of pressure against the wires and the intervening paper. The operation of this roller so situated, gives the continuous sheet of paper sufficient strength and tenacity to allow it to be taken off the wire web, which is immediately done by the paper on the wire web being brought into contact with a roller carrying an endless felt of open cloth, to which the paper adheres in preference to the wire work mould. It is then carried forward by the endless felt, when the paper is made to bear against another series of rollers carrying another endless felt: the paper is thus pressed and drained between two cloths, before it is carried between the ordinary pressing rollers, whence it is delivered sufficiently manufactured to pass between the drying cylinders.

This invention appears to be of some practical value, and we should have given a drawing of it, had it not been so negligently and incorrectly specified as to render some parts unintelligible.

The claim relates to the mode of giving pressure to the paper after it has passed under the main cylinder, and to the subsequent pressure between two endless felts. [*Ib.*

To W. MASON *a patent for improvements in the construction of wheel carriages, was granted on the* 10*th of August*, 1831, *and the specification was enrolled on the* 10*th of February*, 1832.

THE intention of this patent is to afford the means of turning four-wheeled carriages without diminishing the size of the fore wheels, or cutting recesses into the frame work or body of the carriage for the reception of the wheels in the act of turning. This important object is proposed to be obtained by means of joints in the fore axle-tree, between the carriage frame and the naves, to allow the ends of the axle-tree to move horizontally backwards and forwards without altering the position of the middle portion, which remains eminently right across the carriage. At each of the joints, and connected with the portions of the axletrees which fit into the naves, is fixed a bar which connects the wheels with the splinter bar, to which it is jointed, so that the middle portion of the axle, the splinter bar, and these two side bars, form a parallelogram, which remains rectangular only, while the carriage is proceeding straight forwards. The pole of the carriage is likewise jointed to the middle of the axle and to the middle of the splinter bar, by which means any change in the position of the pole to the right or left will cause a corresponding change in the position of the levers constituting the before mentioned parallelogram, and consequently prepare the wheels for turning.

We have not deemed it necessary to enter upon the minute details by which the patentee shows in his specification, the proportions of the various parts of his arrangement, so as to afford the re-

quisite strength to an axle with vertical joints, as what we have stated will be quite sufficient to give the reader a general idea of the principle and application of the invention. [*Ib.*

To HENRY HOPE WERNINCK *a patent for improvements in apparatus or methods of preserving lives of persons and property when in danger by shipwreck, by speedily converting boats or small vessels of ordinary description into life boats, and other apparatus or means applicable to the same objects, was granted on the 24th of September,* 1831, *and the specification was lodged on the 24th of March,* 1832.

THIS invention, which is said to be the communication of a foreigner residing abroad, consists in various methods of making and applying buoyant apparatus. The patentee first describes the method of manufacturing a buoyant balloon, made of a series of fifty or a hundred bullocks' bladders, which are to be cleaned and prepared by removing carefully the necks, and portions of fat which may be left adhering to them, turning them, and oiling well with linseed oil on both sides, then filling them with air, and securing well the aperture through which they have been filled by the introduction of a short wooden pipe, and a well fitted plug. The bladders are then to be attached to a hoop of an appropriate size, according to the weight which they are intended to carry ashore. Over this hoop and these bladders is placed an egg-shaped canvas bag, preserved in its distended form by means of a light cane basket. A bladder is also used, after having been prepared as above, for conveying a letter from a ship in distress to the shore. In this case the wooden pipe which is inserted into the neck of the bladder, is made sufficiently large to admit a letter rolled up. The aperture is then securely plugged up, and the apparatus committed to the water, on which it will float with a velocity nearly equal to that of the wind. This, it is contended, may be frequently the means of conveying to the persons on a lee shore, or to those on board other vessels to the leeward of the one in distress, intelligence in time for relief to be afforded.

Another method of making buoyant apparatus is described in this specification to consist of Dutch or other light rushes, or similar substances cut into appropriate lengths, according to the size and form of the intended apparatus. They are then to be tied securely together, covered with strong brown paper or pasteboard, or both, moistened and pasted so as to prevent the passage of air: after this a covering of bladder is applied, and the parts of which it is composed are securely cemented together; and, lastly, a canvas covering is to be applied, and the whole secured by resinous varnish and coal tar, so as to render the apparatus impervious to water.

Amongst the numerous instances which the patentee furnishes of the application of the buoyant bunches of rushes, are their introduction round the edge, over and under the seats of a common boat, to

convert it into a life-boat, to a man's person in the form of a floating jacket or dress, to render him buoyant in the water, or round his waist, in the form of a large annulus or collar; and lastly, it is proposed that a horse shall be surrounded with a buoyant dress reaching nearly as low as the feet of the rider, so that the animal may be enabled to float on the water, without being at all sensible of either his own weight or that of the rider. [*Ib.*

To WILLIAM BINGHAM, *Esq. and* WILLIAM DUPE, *Gunmaker, a patent for certain improvements on fire arms of different descriptions, was granted on the* 24*th of September,* 1831, *and the specification was deposited on the* 24*th of March,* 1832.

THE introduction of percussion powder instead of flint and steel for igniting gunpowder in fire arms, has given rise to a very great variety of modifications in the construction of gun locks, and amongst others to the one before us, in which it is proposed to make the barrel terminate in an acute conical cavity within the breech, and from the apex of this hollow cone proceeds the touch hole to the priming nipple. The hammer, which is operated upon at once by a straight main spring, strikes the nipple within the stock, so that there appears nothing on the exterior but the handle by which the cocking is effected. The seear and the trigger are likewise much simplified, being but one piece. The whole arrangement is simple and ingenious, and appears well suited to the purpose for which it is designed, though there are many parts of the lock which approach very closely to other patent contrivances having the same object in view.

These patentees propose in addition to the foregoing, a very material alteration, and, we are inclined to think, considerable improvement in the manufacture of the stocks of muskets and other fire arms. They propose to make the whole, or at all events the principal parts of the stock of sheet iron, by which they contend that the cost of manufacture will be diminished, while the stocks will be rendered more useful, particularly when applied to military purposes; and much more durable, as they will, according to the specification, last almost forever. A piece of sheet iron is first cut out of the form of an isosceles triangle, whose central length is about twice its breadth at the base; this then is bent into the required form by means of a saddle backed anvil, or block, and suitable tools. It is then to be cleaned and painted, or japanned inside, to prevent it from rusting; then to be securely fixed to the fore part of the stock, which may be either made of iron or of wood, in the usual manner, according to the purposes for which it is intended; the preference is, however, given to iron. The butt end and the top are to be inclosed by soldering in plates made to fit the opening, but if the stock be intended for a soldier's musket, the end plate is made to open to admit a soldier's provisions, or ammunition, and thus the utility of the musket will be

augmented. The exterior of these iron stocks is to be bronzed of the usual colour of gun stocks, or of any other, to suit the taste of the manufacturer or his customers. [*Ib.*

To WILLIAM DRAKE, *Tanner, a patent for improvements in tanning hides and skins, was granted on the 7th of October,* 1831, *and the specification was enrolled on the 7th of April,* 1832.

THE principal novelty in this patent consists in applying the tanning liquor on one side only of the skin, and causing it to ooze through the skin to the other side; from whence the aqueous portion of the liquor is chiefly abstracted by evaporation. The result of this process is said to be, that the skins are more thoroughly and uniformly tanned, and the operation is completed with *cold* liquor in ten *days* instead of ten *months.* If this statement should prove to be true, and we see no good reason to doubt it, the patent is one of great value and importance.

The specification informs us that the skins or hides to be tanned are to undergo the usual primary process of *liming;* they are then to be immersed and well *handled* in a vessel containing *backward,* (which is a weak solution of tan,) until thoroughly saturated, which removes the lime and prepares them for a stronger impregnation. Thus prepared, the skins, excepting such as are intended for *butts* and *middlings,* which are shaped accordingly, are to be rounded (i.e. their irregular edges taken off,) then two of them are to be laid together face to face, and be carefully sown together with waxed thread at their edges, so as to form a kind of bag impervious at the junction, leaving a small opening at the shoulder for the insertion of the neck or spout of a funnel shaped vessel; but, it is to be observed, it would be preferable to sew between the skins a collar adapted to receive the end of the funnel. As bags so formed would bulge out when filled, they are to be confined between two-gridiron-like frames of parallel bars adapted to compress the bag in such a manner as to produce internally a vertical stratum of liquid of about an inch between the two skins; and as the skins are thickest towards their middles this variation is compensated for, by cutting away a portion of the vertical wooden bars from a straight into a hollow curved line. The skins are suspended by loops to the bags, which traverse the upper horizontal bars of the frames, and the two frames are duly drawn together by four screw bolts passing through the extremities of the top and bottom bars. The funnel being inserted into the aperture between the skins, it is charged with strong tan liquor sufficient to distend the bag and leave a surplus quantity to supply the loss by evaporation after the moisture has penetrated to the outside of the bags; a small gutter at the bottom of, and between the frames, receive whatever liquid may drop from the skins, and conduct it into a vessel, by which it is returned whenever necessary into the funnel reservoir above. To prevent the compression of the vertical bars from form-

ing permanent indentations and ridges in the skins, the patentee directs that the bags be occasionally shifted a little laterally.

To facilitate the evaporation, and consequently the absorption of fresh solutions of tan, the operations are recommended to be conducted in chambers artificially warmed, and the liquor which oozes through the skins, and is received into the gutters, is directed to be conducted into vessels acting the part of refrigeratories, in order that *cold* liquor may always be supplied to the skins; but how this liquor is to be preserved cold in a warm chamber, the specification omits to inform us.)

When the skins are sufficiently tanned, which is well known by various indications to practitioners in the line, (chiefly, by their increased thickness, hardness, and russet colour,) a stitch or two of the sewing at the bottom of the bag is opened, and the liquor is received and carried off by the gutter underneath.

The claim to invention does not consist in the mere application of liquor inside of a bag formed of skins, but to the general combinations, and especially to the mode of accelerating the penetration of the tanning liquor by exposing the outer sides of the skins to evaporation.

Although we have a very favourable opinion of this process, and that great economy will result from its adoption, there appears to be one defect in it. The skins being laid vertically, the pressure of the column of liquid will cause a much more rapid absorption of the tan in the lower than in the upper part of the skins; and if no injury is produced to the lower by continuing the process until the upper is fully saturated with tan, there is at least a loss of time. It is also probable that the liquor is stronger at bottom than at top of the bag. From both these causes, therefore, we should not expect that the leather produced would be very uniform in its quality. To obviate these defects, we would submit to the patentee, as a preferable arrangement, (and one which will not affect his patent right,) to suspend his frames midway upon axes of rotation, and to fix at each end of his bag a charging vessel with a stop cock, or some other simple contrivance to answer the same object. The bags may then be reversed at pleasure, or placed in any desired position, and the lateral shifting required between the bars will take place of itself. If there were only one charging vessel with a stop to it, it would suffice, as by turning the frame round half way, it may become the discharging aperture. [*Ib.*

To WILLIAM LLOYD WHARTON, *Esq. a patent for certain improvements in engines for raising or forcing water by the pressure and condensation of steam, was granted on the* 30*th of January, and the specification was enrolled on the* 30*th of March,* 1832.

STEAM engines, on the principle introduced by Mr. Savary, are those intended to be improved by Mr. Wharton's invention; but in-

stead of allowing the steam to come into contact with the surface of the water in the cylinder, he interposes between the two a large hollow float, of an exterior diameter very nearly equal to that of the interior of the water and steam cylinder. Over the water in the cylinder is introduced a quantity of oil, which passes up the sides of the float, and prevents the steam from ever coming into contact with the water to be acted upon. After the steam has been admitted from the boiler into the cylinder, and forced down the float, and consequently the water underneath, it is conveyed to a conical condensing vessel considerably elevated above the cylinder, where it is condensed by means of a jet of water admitted from another vessel situated immediately above the condenser. And thus a vacuum is obtained in the upper part of the cylinder, which allows the atmospherical pressure on the surface of the water to send up a quantity sufficient to elevate the float to the top of the cylinder, when the steam is again admitted to force down the float, and through that medium to force the water, now occupying the cylinder, to ascend a delivery pipe to the required elevation. The supply pipe is provided with a valve, opening upwards, to prevent the return of the water into the well, or reservoir, from which it has been raised; and the delivery pipe is also provided with a valve opening upwards, to prevent the return of the water into the cylinder when the vacuum is created.

A tumbler hammer is introduced for the purpose of opening the communication between the steam boiler and the cylinder, and closing the communication between the cylinder and condenser when the float reaches the top of the cylinder, and of reversing the stop cocks, or valves of these communications when the float reaches the bottom of the cylinder, thus rendering the engine self-acting as far as regards the opening and closing of the steam communications.

[*Ib.*

Patent granted to BENJAMIN AINGWORTH, *Button Maker, for an improvement in the making and constructing of Buttons. Dated August* 30, 1831.

THIS patent is for a minute improvement on that of Mr. Aston, of Bromsgrove. It is not that we, with Sylvester Daggerwood, have "a soul above buttons," but we find it extremely difficult to understand the exact degree of improvement to which the patentee lays claim. We had no idea that the mystery of button making was so abstruse. It appears from the evidence of Mr. Aingworth that a button could never be made at all, if it had its own way, and was not absolutely compelled to be a button. Animals are tenacious of life, but buttons show a yet more remarkable tenacity of nonentity. Would the reader believe it? Three plans are appended to this most voluminous patent, which occupies as much parchment as would make a million of buttons, and that these three plans represent an army of figures and a myriad of means to compel the reluctant elements of a button to cohere and become a button! First, a piece of cloth of a peculiar

texture, is cut out larger than the size of the intended button; then two or three, or more pieces of thick paper; then a metal plate; then a bevilled steel ring; then *encore du papier;* and, "conclude with the cloth," as they say in quadrille dancing. So much for the materials, in which there is little new but the paper. These are divided into two portions; the former cloth, paper and steel, are put into a barrel, or rammer, or tube fitted into a bench, or frame, or,—may we name it?—a shop-board. In this tube, by means of a plug, the materials are pressed together. A similar barrel receives the other portions of cloth, steel, and paper, which are in like manner compressed. The two tubes are then united, and the whole of the component parts of the buttons are pressed together so as to form *one.* The edges of the cloth and paper are turned round the bevilled ring, and being then removed to a very pretty instrument of the press kind, the button receives its last squeeze, and comes out completed.

After all these perils, the button is supposed to be superior to any button that has suffered less. It can be stitched to the coat without an elastic neck; it sits more closely, and its soft edge does not wear the cloth as a metal one would do, (the ring, or plate, being wholly covered by the edges of the softer materials,) and Mr. Aingworth thinks that he has achieved much in making a button without a neck. We have no doubt that the improvement is great, but we cannot understand it. The more kinds of buttons the better; the more machines, the better; the more hands employed, the better; and the more patents the better, say we. We heartily wish that better times may come soon, that men may wear more buttons to their coats, and more coats to their buttons than the present times will afford.

[*Rep. Pat. Inv.*

¶ Royal Ordinances of France relating to Steam-Boats.

(Translated for this Journal.*)

Circular of 1st June, 1830, to the Prefects of Departments in relation to the instructions appended to the Ordinances of 2nd April, 1823, and 15th May, 1828.

Sir,—You have received the circular of the 1st of August, 1828, relating to steam-boats and to the boilers of the steam engines used in those boats.†

At the end of this circular will be found the two ordinances of 2nd April, 1823, (Bulletin of Laws, No. 601, p. 306,) and 15th of May, 1828, (Bulletin of Laws, No. 233, p. 497.)

You have doubtless attended to the formation of the committees of superintendence, to be appointed by the Prefects, (according to

* We observe that the translations of former ordinances made for this Journal have been transferred, *without acknowledgment,* to the pages of the Register of Arts, and Journal of Patent Inventions, (London.)—Trans.

† See the translation in this Journal vol. vii. p. 272, 323, 399, and vol. viii. p. 32.

article 1st of the ordinance of 2nd April, 1823,) of the Departments in which there are rivers, or which are upon the sea-board, and where steam-boats are or may be established. These committees have very important duties to fulfil, in which the prosperity of commerce, as well as human life, is interested.

The ordinance of 2nd April, 1823, has left to the authorities the task of completing the details of the system.

I have published a special instruction, in order to facilitate the execution of the ordinances concerning steam navigation; and to establish, as far as is possible, uniformity in the local regulations which it is the duty of the prefects to draw up. It has been prepared after mature consideration by the committee of engineers of mines, and of civil engineers, (organized in 1823,) which have charge of all questions relating to the steam engine.

This instruction contains, in addition, explanations respecting the internal police of steam-boats.

You will find copies of it enclosed.

The instruction contains the provisions of the ordinances and directs the mode of executing them. There is an express prohibition against proving by the hydraulic press, (and consequently against stamping,) any boiler terminated by plane ends, which thus differs in form from the proper high pressure boiler.* These boilers, with plane ends, could not be proved without being put out of shape; they are only worked at very low pressures, and are not dangerous when provided with safety valves loaded directly, with fusible plates, and with an open steam gauge.

The instruction is divided into seven paragraphs, relating,

1st. To the superintendence and management of the engine.

2nd. To the feeding of the boiler.

3d. To the safety valves.

4th. To the fusible metallic plates.

5th. To the gauge.

6th. To the management of the fire.

7th. To the internal police of steam boats.

By the first of these paragraphs, it is made essential to the permit of navigation that there be placed on board of every boat intended for the convenience of passengers, an engineer whose *sole* business it shall be to superintend the engine. Great good is expected to result from this measure.

At the end of this instruction is placed a new table of the elastic force of steam corresponding to different temperatures. This table is the result of the labours of a committee of the Royal Academy of Sciences; their perseverance, courage, and ability, merits the highest eulogies. This table, (referred to in the circular of the 19th of May, 1825,) is to take the place of the table contained in the instruction of the 7th of the same month, provisionally reported by the academy.

* This is a most singular prejudice, since the ends can be indefinitely strengthened to meet the strain upon them. It would entirely exclude from use the American high pressure boiler.—Trans.

I beg you, sir, to pay the strictest attention to the contents of the present instruction, and to enjoin the most attentive observance of its provisions on the various local authorities charged with assisting you, and particularly on the committees of superintendence in your department.

I request that you will send copies of it to each member of the committee, to the engineers of mines, to the government civil engineers, to the custom house officers, mayors and adjuncts, to the commissaries of police, to the commissioned and non-commissioned officers of gendarmerie of the cities and communes situated on the lines of navigation, as well as to the proprietors of steam-boats.

In acknowledging the receipt of the present, you will oblige me by sending the names of the members of the committees of superintendence in your departments. I desire further that you will report any changes which may take place in them.

I have the honour to be, &c.

(Signed,) CAPELLE,
Minister of Public Works.

Instructions relating to the execution of the Royal Ordinances concerning Steam-boats. To govern in preparing Regulations for the Departments.

Steam-boat navigation is regulated by the royal ordinances of the 2nd of April and 29th of October, 1823, 25th of May, 1828, and 25th of March, 1830.

By the first of these it is ordered that in the departments where there are rivers or coasts upon which steam-boats are, or may be established, committees of superintendence appointed by the Prefect must satisfy themselves that the engines and boats have due strength.

No steam-boat can have a permit of navigation, until the committee charged with its examination has proved its strength, and the good condition of its engine, and until the Prefect has notified the proprietor that he has received and approves the report of the committee. This notification should always be accompanied by a statement of the regulations which the Prefect may see fit to prescribe to the proprietor of the boat in relation to the general concerns of navigation. Lastly, formal visits of inspection, (and others,) must be made as often as is necessary by the committees, who must give, in their report addressed to the Prefect, their suggestions as to the measures to be taken in case the condition of the engine should require attention.

The regulations of the second ordinance, that of the 29th October, 1823, chiefly concern high pressure engines. A system of precautions is established, which, however, is well known, and has been applied for a long time to high pressure engines used in navigation; excepting, however, so much of the regulations as relates to the

guard walls and to the space around the boiler, it being impossible that such arrangements should be made on board of boats.

The third ordinance, that of the 25th of May, 1828, contains among other provisions one by which the measures of safety prescribed by articles 2, 3, 4, 5, and the first paragraph of article 7th of the ordinance of 29th October, 1823, and also by the ordinance of 7th of May, 1828, are extended to the boilers, boiler tubes, cylinders, and jackets of cylinders of low pressure steam engines used in boats.

The fourth ordinance, that of 25th of March, 1830, concerns steam-boats in part, since it relates to low pressure engines in general. By this it is ordained that the safety valves of low pressure engines used in navigation, shall be loaded directly, and that every engine shall be provided with an open gauge, the length of which is to be determined according to the working pressure of the steam in the boiler.

It will not be difficult to regulate both low and high pressure engines of steam-boats in conformity to the different measures of safety prescribed by the ordinance just stated, if attention be paid to the instructions of 19th of May, 1824, 7th May, 1825, and 12th July, 1828, (which relate to high pressure engines in general,) and to the provisions now to be explained.

The stamps, formerly described, to be used for marking the results of the proof of a boiler, will be struck off at the mint at Paris, and inscribed with the words, *Ordinance of 29th of October*, 1823. It has not been considered worth while to sink new dies for the ordinances of the 7th and 25th of May, 1828, as these are only a continuation of those of 29th of October, 1823.

The degree of fusibility necessary to be given in each particular case to the metallic plates, has been heretofore calculated by means of a table constructed provisionally and published by the government at the end of the instruction of the 7th May, 1825. Since then a set of experiments has been made by the Royal Academy of Sciences to determine, with precision, the elastic force of steam at different temperatures. The result of these labours will be found in the exact and extensive table inserted at the end of this instruction, and hereafter to be used instead of the provisional table.

The makers and proprietors of steam-boat boilers are informed that they can always procure, as heretofore, at the manufactory of M. Collardeau, not only fusible metallic plates, for all required temperatures, but also fusible metal in bars. But it is necessary at the same time to state to them that it is difficult, without practice, to obtain, from the metal in bars, plates which shall fuse at the same degree precisely as the bar itself; it will be much safer for them to make use of plates which have been cast at the manufactory, as these are carefully tested after being made.

The fusible plates should be at least five-eighths of an inch thick, and should be covered on the outside with a cast iron grating to prevent them from swelling out when they are heated near to their fusing point. But in using these gratings it is necessary to increase the diameters fixed by article 5th of the royal ordinance of 29th Oc-

tober, 1823. This increase of size should be such as to make the free surface of the more fusible plate equal to the surface of one of the safety valves, and the free surface of the less fusible plate quadruple that of the surface of the same safety valve. Manufacturers and owners of boilers can obtain at the above mentioned manufactory gratings prepared for plates of all sizes, and so arranged that they can easily be fixed to the boiler and removed from it.

The use, on board of steam-boats, of boilers, and boiler tubes, of cast iron, having been prohibited by the ordinance of 25th of May, 1828, the boilers and boiler tubes of wrought iron, or sheet copper, used on such boats must be proved, (according to the terms of that ordinance and the one of 7th of May, 1828,) under a pressure triple of their ordinary working pressure.

No boiler which is terminated by plane ends, and therefore differs entirely in its form and arrangement from the proper high pressure boiler, shall be subjected to this proof, consequently none such shall be stamped.

Boilers with plane ends could not be subjected to the prescribed proofs, without being put out of shape by them; the proof by the hydraulic press is in this case so much the less necessary, as such boilers are seldom used under high pressures. These boilers work at very low pressures, rising at the highest to an atmosphere and a half.

While such boilers are exempted from the proof by the hydraulic press, their use is absolutely prohibited for pressures exceeding an atmosphere and a half. When used their safety valves must be loaded directly with a weight equivalent at most to half an atmosphere, that is to say, with a weight of seven and a half pounds for every square inch. Further, fusible plates corresponding to the temperature of steam of the pressure of an atmosphere and a half must be adapted to the upper part of the boiler; the first of these plates, i. e. the smaller, should fuse at 251½° Fah.,* and the second, the larger, at 269¼° Fah.†

The cylinders, and jackets, of engines having boilers with plane ends are by no means exempted from the proofs, which, in this case, must be applied as usual, and the cylinders and jackets shall then be stamped an atmosphere and a half.

If it be necessary to adhere strictly to all the prescribed precautions in the management of stationary engines, even more attention should be given to those of steam-boats. In such cases recourse cannot be had to walls, &c. to ward off the effects of explosion, and when accident occurs the lives of a great number of persons are necessarily jeoparded. The local authorities cannot, therefore, exercise too much activity and foresight in the use of the powers which have been confided to them in respect to steam navigation.

Too much care cannot be taken, particularly by the committee of superintendence, in conducting the examination which must precede every permit of navigation. In their report they must give an exact account of the state in which they have found the principal parts of the engine of every boat. They ought especially to satisfy themselves

* 122° Centigrade. † 132° Centigrade.

that the arrangement of the fire cannot give rise to any accidents, that the play of the pump for supplying the boiler is sufficiently great, and that the working power of the engine is sufficient to overcome all the obstacles of the projected navigation.

The royal ordinance of 2nd of April, 1823, has given to the local authorities of each department, the power of filling up the details of the general system of precaution. The authorities should hasten to use the power entrusted to them; many prefects have already done so with success. As it is material, however, that there should be as much uniformity as possible in all provisions of this nature, we now bring into view the principal points to which attention should be paid in drawing up such regulations.

[TO BE CONTINUED.]

¶ On Working Iron and Steel.

The thanks of the Society were presented to C. Varley, Esq. for the following paper.

The society having favourably received the description of my late uncle's method of condensing brass, in which I endeavoured to show the conditions which are requisite for the *extreme* and *uniform condensation* of metal previously sound; and knowing of how much consequence it would be to secure the soundness of anchors, iron tires, girders, and other implements, to which the safety of human life and property are so often trusted, I am encouraged to pursue the subject, and to endeavour to show the means by which iron or steel may be rendered sound, and preserved so while working, and even during welding. But on a subject supposed to be so well known, and in which I must repeat much that is known, for the sake of connexion, it may be well to justify myself by showing, in the first place, how inadequate the ordinary practice is to prevent unsoundness.

Iron.

The welding of numerous layers of good iron together, so as to form one bar, is considered to render it much tougher and more trustworthy than if it had been wrought out of one piece; for it breaks joint with, and equally mixes the strong and weak parts. But many stop here, believing they have done all they can; yet every welding may be discovered which proves that a considerable degree of unsoundness accompanies this process.

If we notice the pump handles about town which are constantly exposed to the weather, some are found where the continual wear from handling exceeds that of the weather: these acquire nearly the best polish that soft iron is capable of. But there are many in which the wear from handling barely keeps pace with the decomposition by weather; in these, the last weldings which united the different parts

* From the Transactions of the Society for the encouragement of Arts, Manufactures and Commerce.

together to form the handle are most distinctly marked, and the various layers of which the mass has probably at different times been formed may be seen, very much resembling the longitudinal grain of wood. Here is sufficient proof of the want of homogeneity; and, seeing it is a constant attendant on welded iron, we are led to inquire what causes the necessity for welding. The answer is, first, the acknowledgment that iron is liable to invisible unsoundnesses, and that by welding they are likely to be distributed among sound parts and thereby equalize the strength of the mass; secondly, that there is a certain thickness beyond which the most governable hammers fail to produce the full effect of condensing the iron all through; and this thickness being far short of that required for anchors and other implements in which the utmost soundness and strength are wanted, such can only be made up by welding. Within that thickness there is no direct necessity for welding; but beyond it we have no means of rendering the whole mass sound. This necessity of sometimes having recourse to welding renders it of consequence to know what there is in the process of welding that makes the laminæ visible.

When newly reduced iron is hammered till it becomes quite malleable and well closed or united, it may be considered homogeneous and sound, from its having no weldings and no carbon, this latter being carried off by the oxygen of the bar, and the beating. Whatever oxygen the surface imbibes in after heatings is beaten off in scales while giving the required shape to the bar. It therefore remains as sound and free from oxygen as before; for oxide of iron is not only brittle, but incapable of uniting by welding with malleable iron.

But when two such masses or bars are heated for welding, they become again coated with oxide; and then, when laid one upon the other and submitted to the action of the hammer, the oxide is shut in, and union of the bars can only take place in proportion as the two plates of oxide are broken up and the subjacent malleable particles are brought into mutual contact.

From this intermixture of oxide and metal arises a spongy texture (more easily acted on by the air than the pure solid metal,) which distinguishes the welding from the rest of the mass. If, therefore, several layers of good iron were welded together and beaten very much out without hammering the edges, on filing these square and cleaning the four sides, a little weak acid would soon distinguish the edges of the layers from their flat sides, and they might probably be counted.

But in ordinary practice iron is never left so: it is beaten in all directions, to give or keep the required shape, which so bends and distorts the layers that they are liable to be found in all directions; yet the lamellar structure remains, however much broken, and when obtained in a suitable degree, contributes to give that ornamental surface called *damask;* and as all much elongated iron, such as nails, wire, &c. show a fibrous texture when acted on by weak acids, this intermixture of oxide may cause variation in that texture.

Now the evils which arise from oxidizing the surface increase with the size of the weldings; for the great length of time the surfaces of large masses must be exposed to an urgent fire to obtain the welding

heat, will cause so deep an oxidation that the union will be so much the more difficult to effect; for there needs a proportionate increase of hammering to break through a thicker coat of oxide, while the difficulty is increased of transmitting the force of the hammer through larger masses to the welding surfaces; so that the union is liable to be as much less perfect as the mass is greater.

Accordingly, as it is very common to meet with anvils whose large beak, and sometimes other parts, are broken off at their weldings, showing how very imperfect the union was, and that only at the edges, and seldom any at the centre.

And as an acknowledgment, by a workman, of the general deficiency of weldings, the society, in 1820, rewarded Mr. R. King for his method of avoiding them, by forging the anvil top, its beak, and opposite overhanging, in one piece, the base in another, and then welding the one on the other; so that in use this welding is the least exposed to strain.

Again: We frequently meet with iron wire that will strip in two like splitting a twig, and sheet iron that will split or peel up in parts; all showing either the inability of producing complete union or of knowing when it is effected.

I have thus far traced the unsoundness which accompanies welding: next I shall show what takes place when the weldings are quite sound; and shall pursue it, if possible, to the obliteration of every sign of previous welding.

If we recur to the melted carburet of iron, which is puddled or brought to a pasty state, and then hammered at a great heat till it has lost all its carbon, and till every part of the metal has united in one mass and become malleable, and observe what takes place during the process, we shall obtain a tolerably good hint for welding. The iron is still considerably divided by an excess of carbon, and probably by other impurities not easy to be defined. These are fast oozing out, and the carbon is burning at the surface, while the hammer is continually bringing portions of the iron into closer contact, so that they unite; and the pure metal being much stronger and tougher than the crude, it will keep together and combine with every particle of sound metal with which it comes in contact while the crudities are exuding; and this goes on, to the improvement of the quality, so long as any carbon remains; for, during that time, perfect welding must go on, because the carbon takes the oxygen and leaves the surfaces pure or clean for union. Thus the iron becomes one solid mass free from oxygen; for oxygen and carbon mutually take each other away in the form of gas, and leave the iron pure. Now, if ever so much hammered after this, the iron may proceed to perfect soundness and homogeneity; but it will be at the expense of the surface, which is detached in scales as it passes to the state of oxide, in which state, as I have before observed, it is incapable of uniting with metallic iron.

The conversion, however, of crude into malleable iron is never perfect till the mass is so reduced in thickness that the welding force of the hammer is felt all through; and then if all the oxygen is re-

moved from within, it may be obtained quite free from flaws (at least all but minute ones,) and is fit for use.

Having thus established some thickness up to which, with given tools, new iron may be obtained sound, we begin to increase that size by welding; and here begins a new and very different cause for unsoundness, which will require our farther notice.

Various means have been resorted to in order to protect the surfaces of iron from oxidation while in the fire, such as sand, glass, salt, or any thing that will bear the fire; but these require to be scraped off before the bars are put together for union. Now, any portion of such matter that is not removed is itself a cause of unsoundness, and when perfectly removed, a thin coat of oxide forms on the clean surfaces and is shut in.

In order to obviate this latter evil, the iron should be coated with carbon, as though it was to be case-hardened, by immersing or laying it on a bed of carbonaceous matter, kept very hot till it has imbibed enough to engage all the oxygen that would otherwise attack it during welding: moreover, this carbon blazing out at the surfaces, helps to keep up the heat till they completely meet together. The surfaces ought also to be slightly convex, that welding may begin at the middle (that part being liable to receive less impression from the hammer,) and proceed gradually to the edges: thus the blisters that are liable to be produced from the union of oxygen and carbon are more likely to be beaten out. And more particularly as the masses singly were as thick as the hammer can govern, and now being doubled, its effect is lessened at the welding surfaces, therefore more care is required in the mode of bringing them together; for unless each part is kneaded together enough to adhere before the heat lowers, some parts will only be beaten close without union; and all after heatings affect the outside more than the joint. Also, if any air is shut in, this likewise retards the union; but a convex surface gives the best opportunity for it to escape.

Next, supposing the iron protected as usual, if, at the moment the substance used for this purpose is well scraped off, the surface is sprinkled with good cast iron, or still better with cast steel filings, this addition will introduce carbon enough to engage the oxygen, and a sound welding may be expected. Here the operation is similar to the original reduction of the iron to the malleable state; for perfectly clean iron unites very readily if brought into close contact at a suitable heat.

This process for uniting iron which otherwise was too thin for welding has lately become public, and by some has been called soldering, under the notion that the cast iron melted between the surfaces.

Iron is too thin for welding if it cannot retain the heat long enough under the hammer (or when the remaining good metal is not enough to squeeze through, or mix up with the oxide) to unite, without being smashed to pieces by the hammer; or if so much flies off in scales that the remainder becomes useless. But by the introduction of highly carburetted iron, the oxygen is consumed and the heat thereby retained a little longer; and the metal becoming all good, or restor-

ed, there is rather an addition than a diminution of weldable substance; and a much less use of the hammer will bring the whole into union.

Now, seeing by this means much thinner iron is united than formerly, it is desirable to apply the same process as completely to large work. For though the mechanical obstacles appear so opposite, the opposing agent, (oxygen,) is the same, and is nearly in proportion to the masses.

Small work, being quickly brought to the heat, is less burnt than large masses; for these, requiring much time to arrive at the necessary heat, receive a deeper coat of oxide. Small work, however, is more disfigured in proportion, by the beating requisite to cause union; whilst in large work the quantity of metal between the hammer and joint resists the operation.

In one case the work is worth nothing unless the iron is preserved; in the other the joint is not sound unless oxygen is excluded, because it can never get so much brisk kneading together as to overrule the enclosed layer of oxide, and force union.

A third method I would propose for very large work, is to protect the surfaces in the most convenient manner while coming to the heat; then carefully cleaning them and laying a thin sheet of clean hot steel that has been highly carbonized between them: this would secure a very sound and equable layer of metal all through the joint, the carbon of which, if more than enough to reduce the oxide, would still not impair the soundness of the metal, and consequently do no harm to the joint.

If by some of these means, either of excluding oxygen or removing it in the process, we are enabled to effect a sound union, we may add layer upon layer of sound metal, till we have obtained the largest required mass. Yet this may, perhaps, be only apparently sound; for here another evil is liable to be introduced, which before was stated to need our attention; and if this is allowed to enter, it will increase with every additional layer.

In order to explain this, let the layers be supposed to be added in succession, all on one side of the first, bearing in mind that we are using the thickest layers which our hammer can govern.

When two are welded together, the upper one is stretched most by the hammer; it is therefore pulling the under one with it, which, if it cannot do, it will divide the exertion by curving a little to it. Now here at once the mass is in an unnatural state of tension, the under piece being stretched like a cord, while by its force it is striving to bend the upper one like a bow. Now, a third layer added on this, will, in like manner, be stretched more than the under ones; and while endeavouring to stretch the second one like a cord, it becomes the antagonist of the first, and would overcome its power to bend the second; but as its relation to the second is precisely what the second is to the first, a strong tendency to a curve is still the result. Now, on proceeding to add the fourth, fifth, sixth, &c. layers, we are continually increasing the stretching force on one side. Therefore these additional layers must either all bend, or the under one be so stretch-

ed as to break or become unsound; for the farther the bottom layers are removed from the hammer, the more do they act merely like an anvil, suffering less and less alteration from the hammer.

Now, if instead of adding only on one side, we added as many layers on the three other sides (leaving the first as a central nucleus) while hammering the outside layers, they would all be enlarged; the inner ones serving little more than the office of an anvil, are, therefore, stretched till they break.

This kind of mischief begins with the first welding, and increases with every layer, and is greatly increased by the quantity of hammering required completely to form and finish the work. For the more the outside is extended by the hammer, the more the inner part is stretched; and as this will bear but little of extension without parting, the mass must become unsound. Agreeably with this, it has long ago been observed, that large masses hammered beyond a certain degree lessen in specific gravity instead of increasing, and therefore it was supposed that a large ball might be hammered till it became hollow. Now, whether the layers be added in succession, or are all heated by welding together at once, the effect will scarcely be altered, for it will require as much hammering fully to effect all their unions, and there will be the same gradation of the hammer's effect; for the outside will be drawn out in length more than the inner. This is shown by trying to lengthen a cylinder by a hammer rather too small; for then the centre not lengthening equally with the part directly acted on by the hammer, the ends will become hollow, and the force of the extended outside will stretch the middle parts to unsoundness. The use of enormously large hammers will carry us farther in size before central unsoundness takes place, but then the surface is the more furiously smashed about.

It remains to offer means of preventing or diminishing this central unsoundness; for though in large work the tools would be expensive, yet where the repetitions are frequent, that is of less consequence; and if one ship was saved by the greater strength of its anchor, it would surely be an offset against the most expensive tools.

The bars, which are to be united into one great shaft or stem, should be all of one length and of the full width; then an anvil or bed of iron should be provided, so large as to contain a recess of the same dimensions as the intended shaft. Through the bottom at each end, and flush with it, iron posts might stand so that they could be raised by levers at their bottom when the work required to be lifted out. Now, prepare two of the layers for welding, and put them into the recess, and have a stamper or welding hammer square ended, as wide as the recess, and let it drop from a carriage travelling parallel with the recess; in this case there is no room for extension either in length or width, the metal can only close, and as there is no lateral spreading to make way for the hammer, its force will be directed more effectually downwards; but as its face would be too broad for its best effect, two men, with a frame like a hand barrow, might carry a short cylindrical hammer-like punch under the stamper, and

distribute the blows equally all over. Where this cannot be done, placing the hammer over an anvil, with two heavy cheeks adjustable to the required width, would prevent lateral spreading and lessen the evil, though it could not prevent the longitudinal stretching. But by whatever means the workmen can prevent all extension under the hammer, soundness will be preserved. The above process being performed on two layers, then bring the mass thus produced to a welding heat, and add a third layer, and so on in succession.

If a ball of clay or putty is rolled into a cylinder, it will show hollow ends, proving the outside to have extended most; and the centre being cracked by the stretching, at last breaks the cylinder all through, and it falls to pieces with cracks sharper than the softness would lead us to expect. I have seen brass wire full of cracks at which it would break, occasioned either by very hard drawing or brittleness of the metal, and these breaks were convex, fitting into concaves, showing that the centre had travelled faster through the hole than the outside; for the convex was towards the hole before it had passed, and from it when passed, and the last end of wire is frequently hollow.

Now, seeing large masses are so liable to acquire internal unsoundness, and the weldings also difficult to obtain sound, I would, in constructing anchors, totally avoid all weldings across the pull to which they are subjected when in use.

I would therefore take new iron that has only been reduced to the malleable state, in pieces long enough to forge into the complete form of the intended anchor, without flukes, and thin enough to be quite manageable under the hammer. Having provided a quantity of these, I would weld together (as previously mentioned) by carburet of iron sprinkled between them, a sufficient number to give the required thickness, with some contrivance to prevent all extension, but should prefer a recess capable of receiving the whole anchor. This would produce square limbs, and I should prefer chiselling off the corners to hammering them in; for if they were hammered in, it would put some parts in a state of greater tension than others, and destroy that equal ease throughout, which is so very essential in an anchor, where every part should contribute equally to bear the strain; for those parts that are left in a state of tension chiefly bear the pull, and must give way before the others can come to their full tension; therefore the anchor breaks. Perfect soundness of the iron, an arrangement of the weldings so as to be in a line with the pull and ease of all the parts, or an equality of their state and freedom from tension, are the three most essential requisites in an anchor, after its form has been determined.

From these considerations, I think it will appear that many anchors are rendered unsound by the hammering, and that the metal is liable to be put into such an unequal state of tension, that one part at a time only bears the strain; so that with the weight of a large anchor we have only the strength of a small one; and when this is the case, can we wonder at their breaking?

There remains yet another view in which the use of large implements should be considered; namely, at what thickness can any given material be used with the best advantage. This leads to the inquiry, whether there are any limits in this respect as to thickness and length; and if so, what is their nature, and do any implements exceed those limits.

Now, an anchor is the largest hook in use, and is exposed to rougher, or more violent usage than any other, and that even in proportion to its greater size, on which account it ought to possess every good quality of metal. But I fear this inquiry will show that the largest anchors do exceed the limits of some of the most important qualities.

To seek for these limits, we must look at matter much reduced in size, and compare it with the largest masses, and we shall find a greater contrast than in size.

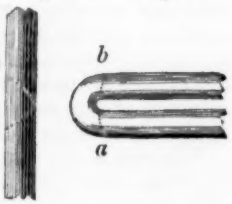
Small pieces fall from any height without breaking, the blow they give or receive not being equal to the force of cohesion between their particles. Now, on increasing their size, the sectional surface to be broken increases as the square, while the weight increases as the cube, therefore large bodies break from falling.

If we sufficiently reduce the thickness of very brittle materials, such as glass, they are found to be flexible: glass may be drawn out so thin or fine as to bear twisting together and forming thread, and it bears throwing about; while the same substance in rods two or three inches thick, will break rather than bear bending enough to be discovered by the nicest measurement.

If we could have wire so small as to consist of one line of particles, it would lose all character of stiffness, and bear unlimited bending (such an imaginary wire may be imitated by a line of small magnets between two large ones;) and if it consisted of three or four lines of particles, no bending could remove them out of the sphere of their mutual attraction; such a wire, therefore, would never break. Now, the smallest soft iron wire bears so much bending about, that it appears, in this respect, more like lead than iron of large dimensions.

This flexibility continues so far, that soft iron wire, about one-eighth of an inch thick, may be bent double, while cold, without fracture. Here the outer portion *a b*, fig. 1, about two thicknesses long, is bent and stretched into the curve *a b*, fig. 2, about double the former length; the fulcrum round which it begins to bend is probably one-third within, but it must ultimately remove to the outside, as will be seen by the figure.

Fig. 1. *Fig.* 2.



We may observe that a considerable angle is made before there is much stretching: this is of the greatest consequence, as it immediately engages a longer portion of the metal to stretch and contribute to the bending; for

where there is any curvature the metal is stretched: this will be understood by bending wire into a spiral round a very small axis, when it will have a constant succession of bending parts, and the whole outside will be stretched. Now, after the angle is made, the outer side, while bending and stretching, is forcibly pulled closer towards the fulcrum, therefore, the change of place of the particles is not so great as it appears; and the reason the wire seems not to have lost any thickness at the bend, is owing to the bulging out of the inner side, nearly making up for what is lost on the other; the inner portion is so hardened by the pinch, that there is a little lateral sliding round it while making the bend.

Now, supposing we have begun with the thickest wire that will bend double, let us take some of twice that thickness, the sections of the bending portion will contain four times the surface, but the quantity of metal engaged in bending is eight times as much; therefore the amount of its cohesion is now doubled; and in consequence this wire cannot be bent so much as the other without breaking.

Next take a rod of ten times the diameter of the wire; its sectional surface, the cohesion of which resists breaking, will have increased a hundred times, while the quantity of metal to be bent is increased a thousand times; this is ten times as much in proportion to the cohesion, and the lateral change of place among the particles requires also to be ten times as much: but we supposed the first wire to be the thickest that would bend double, consequently there was all the change of place among the particles that the metal could bear; but in this latter case, ten times the former amount of change of place being required, with ten times the proportional quantity of metal to the cohesion, the rod must rather break than bend.

Steel or iron wire one-twentieth of an inch thick and a foot long, will bear throwing about any how, and suffer little from bending; but if, with the same proportions, the thickness be one foot, the length will be 240 feet, and its weight somewhere about 80,000 lbs.: this, it is evident, could not bear falling from a height proportionally great, or even being lifted from one end like the smaller.

Thus the power of bending decreases as the thickness increases; therefore, in very large masses it is almost nothing; and this same reasoning applies equally to the springing power of large masses.

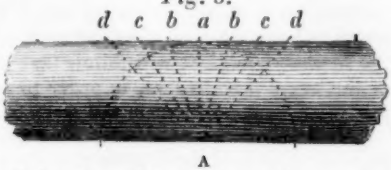
Now, seeing that brittle bodies become flexible by reducing their thickness extremely, so the most flexible bodies become, as it were, brittle by greatly increasing their thickness: therefore, I think we may come to this conclusion, that there is a given thickness at which metal loses all power of springing or bending, and therefore a blow powerful enough to require its yielding will be sure to break it, because it cannot yield in any other way.

We may notice that after a certain quantity of bending, the iron becomes so unequally stretched, that some parts are rendered weaker than the rest; these cannot bear the same exertion, and so must give way.

When a bar receives a blow, or takes one by falling from a great

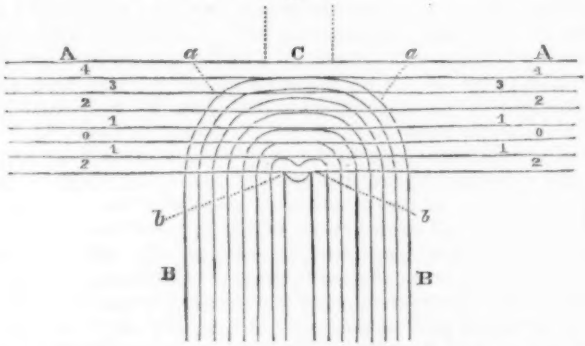
height, it must either spring, bend or break, at the part struck, because the section there is the shortest, as at *a*, fig. 3. Supposing A the fulcrum or blow, the sections *b c* and *d* rapidly increase in length, and therefore soon limit the portion whose strength has to resist or oppose the momentum or weight of the two ends, and when it bends, the section *a* is most stretched, *b c* and *d* successively less as they are longer; therefore *a* is the only part stretched to the utmost; but when a curve is made by a little bending, then there is just so much added that can stretch like *a*, or at least like *b*.

Fig. 3.



It may, perhaps, be allowed here to give another view of what takes place while bending. We will suppose a bundle of square rods A A, fig. 4, perfectly fixed together at their ends, so that they cannot slide, to be forcibly bent as to B B. In this case the rod marked *o*,

Fig. 4.



or one near that place, would simply bend; No. 1 below it would thicken and shorten, while the bottom one 2 would bulge out, making three bends like the letter M; then Nos. 1, 2, 3, and 4, above, would all have to stretch as well as bend, and while their middle was stretching there would be a little sliding round the fulcrum or the two shoulders formed in the lower bars, the upper bar stretching most, and the middle part c in all four of them stretching more than the adjoining parts, as is shown by the sections in fig. 3. Now, if instead of the rods being so small as to bear bending, we suppose each rod to be the thickest that will bear to be bent so much, it is evident they will not bear the additional quantity of stretching and sliding requisite to allow of their taking the form B, B, for the parts *a a* would have to descend to *b b;* a portion *d d*, as wide as the fulcrum is thick, is pulled straight just before rending, and in all cases of bending that straightness is a signal to go no further, for the bar will break.

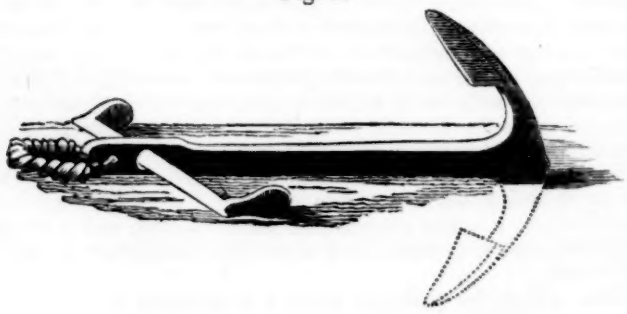
Now, seeing the power of bending or springing decreases as the

thickness increases, and that the weight (the momentum of which endeavours to break any body which falls suddenly on a hard resistance,) increases as the cube while the strength increases only as the square, I think it will follow that anchors ought to increase more in thickness than in size, in order to make up for their loss of flexibility, and enable them to fall without breaking.

This leads us to inquire whether anchors are formed so as to answer equally well their three principal services: the first, to be sure of taking hold; the second, to bear the great strain and jerking to which they are subjected while in use; and the third, to bear falling; and sometimes a fourth, the capability of being withdrawn from a good hold.

With respect to the first, the flukes are probably as broad as the strength of the anchor will bear; for if they were broader, they sometimes would be liable to be twisted off when the ship swung round with the tide; and the form of the hook is evidently good for taking hold, and running that hold up to the shank; but as the fluke is the chief resistance, the arm should begin to curve from the fluke gradually into the shank: but the wooden stock which obliges the anchor to take hold, offers as much surface to the ground as the fluke does; this added to the rising angle of the pull, prevents the whole anchor from diving through soft ground to a harder bottom in which it can hold. The power of diving might be given by using iron stocks, made to turn in the anchor, with the arms, fig. 5, flattened, and round disks at their ends turned inwards enough to make the flattened arms present their edge to the sand or mud in such an angle as to be able to dive. Again, it is not well to drop an anchor with any additional weight, as that would tend greatly to break it; but if a stop were put on all cables three or four fathoms from the anchor, and a weight like a collar allowed to run down the cable to this stop whenever the anchor was found to drag, it would cause such an angle in the cable as to make the portion between it and the anchor lie on the ground and pull horizontally: this weight would also act like a spring, for when the ship tugged at the cable, endeavouring to straighten it, it would have to raise the weight before the anchor could feel the tug, and then it would never be so sudden or so much upwards as without a weight.

Fig. 5.



With respect to the second condition, the action of a hook is the severest strain that metal can be put to; therefore, nothing but the most careful gradation of form, regularly increasing the strength from the stock to the bow and from the fluke to the shank, and curving the shank better into the bow or arms with really sound metal, can distribute the strain equally.

Thirdly, the bearing a fall: an anchor is so formed that it cannot drop on a hard bottom without strain somewhere; and as we can only meet this by increasing the thickness more than the size, and as with this thickening it will be gradually losing the form of an anchor and approaching that of a block, it becomes a query whether, for the largest anchors, Parks' mooring block (which was rewarded by the society in 1818, vol. 36,) is not the best, weight for weight, because it will dive till it finds hold, and a stopper may be put on the cable to prevent it from diving too deep to be easily withdrawn.

There are two somewhat similar operations by which metal is fitted for our use, that deserve our consideration, because in one it evidently loses strength laterally, although it gains it longitudinally. These are wire drawing and rolling out into plates: in one case it is drawn through holes successively reduced in size; in the other it is drawn between hard rollers successively placed nearer to each other.

This produces a character rather extraordinary for metal, for it becomes fibrous; and this texture may be satisfactorily shown, by submitting a piece of it to the slow action of weak acid. Some have attributed it to crystals which kept their separate character while being elongated. But if we carefully trace the progress of the metal through the holes or between the rollers, we may probably find sufficient cause for an elongated or fibrous texture.

The metal is caused to pass through the holes by pulling and not pushing; therefore the quantity reduced each time must be small compared with the thickness of the wire, because it is the mere tension of the reduced part which causes a complete change of place among the particles, or the squeezing of larger rings or short cylindrical portions successively into a smaller size, and elongating them in proportion. This elongation takes place in the hole, where the metal is stretched nearly to the utmost, and it may be considered as analogous to drawing a cylinder or core out of a tube; and this core is so much stretched as to receive into itself the whole of the outer coat, which thus sinking in becomes part of it and follows by its cohesion. Now, as these successive rings are too large to go through the hole, they cannot contract and dive into that below but by a longitudinal sliding of the particles, some sliding aft to let the others close and proceed through the hole. Now, as the elongation is unlimited while there is room to reduce, the centre would be torn asunder, did not the outer metal dive and fill it up; then, as cohesion, or the power which resists parting, is the cause of this, the whole portion at the hole may be considered almost as in a liquid state while passing through it. During this motion and change of place among the particles, if there is any sort of polarity in them, this is the time they are called into action, and can arrange themselves, and

that arrangement must be longitudinal; but the longitudinal sliding of the particles to allow some to proceed first through the hole, and the continual wedging of portions of the outside into the central parts to supply the current of particles through the hole, (for it is like a current,) the particles re-arranging themselves and following by mere cohesion, appears sufficient to produce a tendency to longitudinal fissures, by which the coherence is somewhat weakened, although no real division takes place.*

In the flatting mills the revolution of the cylinders helps to carry the metal through; in that it differs from wire drawing; but though there are no side stops, the metal scarcely spreads any thing in width, proving that there is no pressure of the particles together laterally, but that the mass is elongated just as the thickness reduces; here the rollers pinch tight the reduced part and forcibly carry it through; while the thicker part, like a wedge, refuses to follow, so it is stretched somewhat like wire drawing and the surface is driven back in waves. Here the whole action is lengthwise, and each line extends without regard to its neighbouring lines, so that its lateral adhesion is weakened; and as a thin plank will bend lengthwise, but will split rather than bend crosswise, so will hard rolled plate metal. Annealing and hammering once or twice till hard again, by distributing the extension in all directions, removes this parallel fibrous character. This change of character, according as the metal is worked, shows that none is so strong as that which is beat in a recess; and I think no fibres could be discovered in such metal; for, if I may use the expression, it would be one fibre spreading every way; in fact, it becomes quite dense and homogeneal.

I have now endeavoured to show that oxygen entering with each welded surface deteriorates the iron; and have proposed some and pointed to other means which have been found capable of avoiding it.

Also, that the difficulty of transmitting the force of the blows to the inner surfaces increases with the thickness, and therefore limits the thickness at which sound welding can be obtained.

And when the hammer is used for lengthening a mass, the outside is chiefly elongated, from the effect of the hammer regularly decreasing as the centre is farther from the surface; so that, at last, it receives no impression, but, with the mass below it, serves only the office of an anvil, merely helping the hammer to extend the outside, in which case the centre always becomes stretched, and thereby weakened, and sometimes torn asunder; and as each side while

* When reducing some thick wire in the lathe, to make a small screw with a large head, it proved so unsound at the centre as not to bear reducing to the required size; it did not break off, but tore aside; and on twisting it about with the pliers, the whole of the reduced portion appeared fibrous, so that the wire seemed to have a pith within it. In this instance the centre must have stretched more than the outside could supply while drawing. It would be desirable to try which would give the soundest centre,—the reducing wire through the fewest possible number of holes, or greatly increasing their number and bringing the wire down very gradually; then drawing some very slowly, and some as quickly as possible.

lengthening under the hammer endeavours to bend the mass, it causes an alternation of the stretching, or springing, so as to facilitate the cracking of the centre.

Thus, while small masses are rendered dense and stronger by the hammer, large ones suffer loss of strength if very much hammered.

[TO BE CONTINUED.]

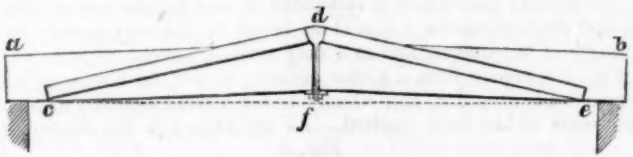
¶ METHOD OF TRUSSING GIRDERS.

The thanks of the Society were voted to ALFRED AINGER, Esq. *of Doughty Street, one of the Chairmen of the Committee of Mechanics, for the following description of a cheap and simple mode of adding to the strength of girders and other wooden beams.*

THE plan of *trussing*, which it is the object of this paper to explain, was first submitted to the Society in 1824, and several models were subjected to actual experiment, on a tolerably large scale, the results of which will be noticed in the proper place. It appeared, however, that a method of strengthening timbers, similar in principle, and not very dissimilar in detail, had been practised in Scotland, though it was very little known, and less used, in the south. Mr. Ainger's plan, not having been at that time applied to any building, was, in consequence, withdrawn: since that period the suggestion has been realized with so much success, as to render it not improbable that a statement of the economy, simplicity, and effect combined in this method might be usefully published.

The mode of trussing girders, which is exhibited in all the old books on carpentry,—which was extensively and exclusively used till within a very few years, and which is still frequently used,—consists in the addition of an arch-like arrangement of wood or metal, upon the resistance of which alone the strength of the girder is made to depend, the main timber itself forming little more than the support and the abutment of the included arch. This mode is described in fig. 1, where *a b* is the main timber, and *c d*, *d e*, are two inclined

Fig. 1.



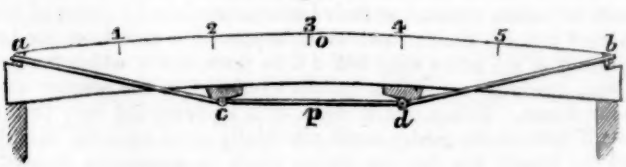
struts or braces, resisted at their lower extremities by plates of metal inserted into the timber, and which support the middle of the beam by means of the screw *king-bolt d f*, by the action of which the girder is bent upwards, or, as it is called, *cambered*, in the manner shown in the figure. When this is done, it is evident, not only that any weight laid on the girder must eventually press upon the king-bolt and the braces, but that the timber itself, on account of its bent or

cambered form, is also exerting a great pressure on the king-bolt, which is likewise transferred to the braces. It is equally evident that, until the girder has sunk in the middle so far as to assume a straight line, it can support no part of the load, but is itself a load upon the braces: a very little consideration will serve to show the inadequacy of these to the strain thus imposed upon them. Their resistance, of course, depends upon preventing their bases *c e* from separating or spreading laterally; in preserving, that is to say, the dotted line *c e* of the same length; and this effect seems, at first sight, to be accomplished by the lower edge of the timber: it is supposed to be so in the calculations made of the strength of girders trussed in this manner. But in order that the lower edge of the girder should act the part thus assigned to it, the woody fibres at that edge must be in a state of tension, like a heavily-laden chain or rope. Those fibres are, however, in a state of compression instead of tension, inasmuch as they occupy the concave edge of the beam, which is, of course, shorter than the convex edge; the resistance to the braces must take place, therefore, higher up in the beam, perhaps nearly in the middle of its depth,—a circumstance which would alone destroy half the estimated strength of the girder.

Notwithstanding these obvious defects, this mode of trussing continued to be much employed till about the year 1816, when Mr. Barlow, among other valuable experiments, compared girders, trussed on the principle above described, with a plain piece of timber of the same size, and found the latter to be on the average not considerably weaker. Since that time, therefore, in all well-executed works, the lower ends of the braces have been connected by an iron rod in the dotted line *c e*, which may, of course, be brought to any state of tension by means of screws or keys. With this addition the truss is perfect in principle, and its strength is limited only by the strength, substance, and workmanship, of the materials employed. It is, however, difficult, and somewhat expensive to make, in an effectual manner; in consequence of which, and partly, perhaps, in consequence of ignorance of the defects of the old plan, the latter is still too frequently employed. The method proposed and adopted by Mr. Ainger is at least as economical as the old plan; and, though not so powerful as that which is composed of iron braces and a horizontal iron connecting-bar *c e*, will be found to add very greatly to the strength of the timber, and at a very small expense.

Fig. 2 is copied from a girder actually in use, 34 feet long, which supports a leaden flat, and which has not altered sensibly during the two years it has been applied. As before, *a b* is the timber, bent

Fig. 2.



upwards or cambered to about the same extent as in the former case. The trussing consists of a series of iron rods *a c d b*, pulling against iron plates notched into the timber at *a* and *b*, and connected at *c* and *d* by bolts similar to those of a suspension bridge, the rod *c d* being double, to embrace the ends of *a c* and *d b*. The rods *a c d b* form, in fact, a suspension bridge, supporting, by the bolts *c d*, the middle of the girder, the ends *a* and *b* being prevented from approaching by the opposition of the woody fibres at the upper edge of the timber. If, however, this were all, it is clear that the girder would have a defect exactly the counterpart to that described in the last case. The cambering would cause the upper fibres to be in a state of extension; they would, therefore, rather promote than resist the approach of the points *c f*, and the resistance must take place, as before, nearly in the middle of the depth. But in this case the objection is very easily and completely remedied by merely cutting notches, about one-third of the girder's depth, in its upper edge, as 1, 2, 3, 4, 5, and filling them, after the girder is bent, with thin wedges of hard wood or metal forcibly driven in. By this means the upper edge of the girder is put into the best possible state to resist, by its anti-compressive force, the tension of the iron rods, the strength of which alone limits the strength of the girder.

For calculating the size of the iron rods proper to be applied in any particular instance, the following will furnish an example:—Good wrought iron tears asunder with a force of about 28 tons on each square inch of section; but it extends sensibly with half that weight, and should not in practice be loaded with more than one-fourth, or 7 tons per square inch. The depth of a girder, such as fig. 2, may be represented by the distance from the middle of the notch 3 to the middle of the bar *c d* or from *o* to *p*: suppose this depth so measured to be 14 inches, suppose the length of the girder between the bearings to be 34 feet, and suppose it subject to a load on its centre of five tons: the requisite area of section for the iron bars in square inches would be, in that case, $\frac{204 \times 2.5}{7 \times 14} = \frac{510}{98}$, or $5\frac{1}{4}$ nearly. Here 204 is half the girder's length in inches; 2.5 is half the load on the centre in tons; 7 is the practical strength of each square inch of wrought iron in tons; and 14 is the depth of the girder, taken, as before described, in inches. If the load be uniformly distributed over the length of the beam, its effect will be equal only to half the same load placed in the centre. Five tons distributed thus, in the case just described, would give, as the requisite section for the iron bars, $\frac{204 \times 1.25}{7 \times 14} = \frac{256}{98}$, or rather more than $2\frac{1}{4}$.

In the experiments alluded to, a fir beam, 8 inches square, 12 feet long between the supports, and strengthened by iron rods one inch square, applied in the manner just described, was found to support a weight of between 4000 and 5000 pounds, being more than double what it could sustain without the trussing. A girder of the same size, trussed with iron braces as in fig. 1, and with an iron tie bar one inch square in the dotted line *c e*, exhibited no greater

strength to resist fracture, though its deflexion under similar loads was, of course, less, inasmuch as the compression of iron must be less than that of fir.

I am, sir, &c. &c. A. Ainger.

A. Aikin, Esq. *Secretary, &c. &c.*

[*Trans. of Soc. for Encouragement of Arts.*

¶ *The Carpet Manufactory of Baarn, in Holland.*

Extracted from the letter of a Belgian traveller to a friend at Brussels, and translated by the latter for the Mechanics' Magazine.

"The progress of national industry is a subject as you, my friend, are aware, which is too near my heart, for me not to devote a part of the time I had to dispose of, during my short residence at Soestdyk, (in the environs of the palace of the Prince of Orange,) to visit the far-famed Royal Manufactory of Carpets, in the delightful village of Baarn, a mile and a half (English) from the palace; to which I was the more induced that I have the satisfaction to be acquainted with the Director, Mr. E. G. W. Cohen, a man of genius, and of universal knowledge.

"This manufactory presented nothing extraordinary till it became under the direction of Mr. Cohen; but since then it has attained a degree of perfection not exceeded, if equalled, by any similar establishment either at home or abroad.

"I first visited the dying house, which is furnished with a great number of immense boilers, constructed after the best plans; then the place where the colours are prepared; and next the laboratory where preparatory experiments are first made on a small scale. From these we passed to the work-shop, where all the instruments and machines, from the smallest to the largest, are constructed and repaired. Such is the diversity of objects here, that, at first sight, the visiter imagines himself transported to a repository of arts and trades, or into a vast establishment composed of many workshops united. The best turning lathes, dividing machines, chronometers, and michrometers, engage your attention; then there is a foundry, a forge, a carpenter's shop, &c. &c.; every thing, in short, necessary for constructing and keeping in order the multifarious objects used in the manufactory.

"To describe to you that manufactory itself—the carding, combing, roving, stretching, spinning, reeling, doubling, and turning machines—were an endless task; suffice it to observe, that the machinery is all constructed according to the latest improvements, and all made on the spot, yet in such high perfection as to leave but little, if any thing to desire.

"The products of the manufactory are of great variety. The principal descriptions are as follows:—

"Brussels carpets, with single and double ground and threads.

"Velvet pile, or Wilton carpets, of arabesque, half superior, supe-

rior, high superior, and imperial qualities, with single, as well as double ground, and threads.

"Smyrna or Turkey, and Persian carpets, of different qualities.

"Savonnerie carpets, which rival the richest embroidery or most elaborate painting in execution of figures, flowers, and designs.

"Kidderminster, Venice, jaspé, and cow hair carpets, rugs, staircase carpets, &c.

"Of these, and other fabrics here manufactured, the warehouse in Amsterdam contains many thousand varieties, and of all qualities, so as to suit every rank—the peasant's cot as well as the nobleman's palace.

"They showed me a carpet intended for a drawing room in the royal palace. It would be difficult to imagine any thing more beautiful produced by human labour; the elegance of the pattern, the harmony, brilliancy, and variety of the colours, were surely never surpassed. Another carpet, of a double ground, contained, I was told by the workman, forty-five colours; and I was assured that this magnificent carpet was composed of 243,000 worsted threads, alternately united and detached from each other. This carpet was purchased by the king of the Netherlands, and sent, as a valuable present, to the king of Prussia, and it now adorns one of the finest apartments of the palace in Berlin. A third masterpiece, destined for an altar piece in a church, representing the *Madonna de la Sedia*, of Raphael da Urbino, was a faithful copy from the beautiful and famous copperplate engraved by Raphael Morghen. It was entirely executed in the common weaver's loom, brought to a colossal size to produce a striking effect. This piece was made in a much more ingenious manner than the Savonnerie carpets; the latter are done on a standing chain, and the colours drawn by hand—but the former was worked entirely (with 130 colours,) in the common weaver's loom.

"Some of the Turkey, Persian, and Savonnerie carpets, are worked (*à haut lisse*,) with a perpendicular, or standing shaft, where the colours are arranged by the hand of the workman, and immediately worked in the chain by the loom.

"One of the finest inventions used in France, in manufacturing figured silk, has been here applied with admirable effect. This invention, in utility, may compete with the cotton spinning frames of Arkwright, with Bolton & Watt's improved steam engine, or with Cartwright's ingenious invention of the power loom; while with regard to the variety and multiplicity of designs it executes, it surpasses incomparably all the old methods. And yet it is but a simple machine, having neither wheels nor screws.

"It is known that in order to produce the figure in any weaving, the threads must be successively drawn in a certain order till finished; and it is this which has given rise to the operation called drawing, which consists in pulling up, after each throw of the shuttle, in a prescribed order, one of the threads necessary in the formation of the figure; an operation usually done by apprentice boys. With the machine which I have just mentioned, all the inconveniences of the drawing not only by hand are avoided, but many other advantages are

obtained, which gives the highest perfection to this art, and such as it never could have reached by the old method.

"An establishment of so much importance was worthy the patronage of the government, and it has accordingly honoured it with its special protection. The director, who is a member of different royal societies of arts and sciences, obtained at the exhibition of Ghent in Flanders, in 1820, the silver medal. At the last exhibition at Haarlem, in 1825, he also received the silver medal; besides various medals for several inventions and improvements in the manufacturing of cards for wool and cotton. The royal society of Haarlem for domestic economy, assigned to the director of this fine establishment of national industry, its medal of honour; and at the exhibitions both of Ghent and Haarlem, the king purchased many of the principal specimens produced by the manufactory."

Plan for giving buoyancy to Chain Cables. By John Pole, Commander H. M. S. Maidstone.

The advantage of a hemp cable over a chain one consists in its yielding more readily. Whenever a chain cable forms a curve it requires a great power to draw that curve to a straight line. In moderate depth of water, the curve formed by the chain is very considerable; but in very shoal water, as Table Bay, where ships anchor in four fathoms, and lay nearly with 100 fathoms cable out, the cable is then nearly horizontal, and supported in a straight line by the ground; consequently when the ship receives a blow from the sea it can yield little or nothing, and it snaps. Now, I propose that in very shoal water, as the cable cannot form a natural curve, to make an artificial one, and I think in a very simple and efficient manner. Every ship has always a few empty water casks at hand; four or five good sized casks, would be quite enough, and any thing of a buoyant nature might be employed in aid of them. These casks should be kept slung with a hook and thimble in the lower part of the slings, and when coming to an anchor in moderate weather, I should veer out a moderate quantity of cable, and when it comes on to blow fresh, as I veered I would hook on a cask at every ten or fifteen fathoms, according to the size of the cask and weight of the cable. These casks, from their buoyancy, would festoon the cable when it became slack, and when the ship was forced astern again by a blow from the sea, she would have to pull each of these casks down, and also astern, as every cask would be farther from the anchor with a straight cable than when festooned. In Table Bay there is an under tow setting out, and there is the same, I believe, in all bays when the wind blows strong into them; which under tow would also make a resistance to the casks, as the vessel drew taut her cable, and the ship would then be regularly eased to her anchor, and no sudden shock could be felt. I think a table might be computed to show how much buoyancy it would require for a certain length of cable in a certain depth of wa-

ter to give the most desirable curve; and in fact I think you may give any elasticity you like to a chain cable by this simple method.

These casks, it must be recollected, will be below the influence of the sea, and cannot be injured by it, and the only strain they will feel, will arise from their own buoyancy. After the gale was over, you would, of course, heave in to your usual length of cable, and take the casks off.

Merchant ships find the advantage of chain cables in so many ways, and there are so few objections to them beyond their liability to snap in shoal, and also in very deep water, that if any simple method could be devised to do away with these objections, there can be no question of its great utility. Whether festooning the cable, as I propose, in very shoal water, and in very deep water giving the cable a certain degree of buoyancy to relieve the ship, will have that desired effect, I will leave others to judge.

[*Mech. Mag.*

¶ *First Report of the Proceedings of the British Association for the Advancement of Science, assembled at York.*

[Continued from p. 9.]

The same views are, perhaps, still more happily presented in the following paragraphs, which we really hope will go far to do away with the erroneous impression, still existing in some quarters, of an intentional interference on the part of the new institution with other scientific bodies.

"But there is a defect in these separate societies, in respect to their own immediate objects, which I am sure no member of them would wish to dissemble, and which arises from the narrow basis on which they are of necessity built. It is not only, that the constant converse of men, who, to borrow the expression of Goldsmith, have often travelled over each other's minds, is not half so effectual in striking out great and unexpected lights, as the occasional intercourse of those who have studied nature at a distance from each other, under various circumstances, and in different views; but it is also, gentlemen, that none of our existing societies is able to concentrate the scattered forces even of its own science; they do not know, much less can they connect or employ, that extensive and growing body of humble labourers who are ready whenever they shall be called upon, to render their assistance."

"What numberless suggestions, what a crowd of valuable but abortive hints are continually floating in the thoughts of philosophers, for the pursuit of which time is wanting to themselves! Now I say, gentlemen, that we have among us, scattered through the country, men willing to adopt these unexecuted hints, as they arise out of the profound and varied meditations of more experienced minds, men not incapable of surveying with accuracy a limited district, though they may not pretend to draw the general outline of the map, or fill up the whole of its details. Many such there are who only wait for

instructions, and who require no other stimulus than that of being invited, to render the most essential service to researches and calculations of the highest order; and it is upon this ground especially that we venture to pronounce an institution wanting, which shall not hesitate to make such invitations and to offer such instructions; it is upon this ground that if we now propose to revive in the nineteenth century a plan devised two centuries ago, we see a difference, gentlemen, in the probability of success. Scientific knowledge has of late years been more largely infused into the education of every class of society, and the time seems to be arrived for taking advantage of the intellectual improvement of the nation. Let philosophy at length come forth and show herself in public; let her hold her court in different parts of her dominions, and you will see her surrounded by loyal retainers, who will derive new light and zeal from her presence, and contribute to extend her power on every side.

"Much, indeed, is not to be gained in the more recondite subjects of investigation from the first essays of inexpert inquirers; but let the number of those inquirers only be increased, collect around you, gentlemen, a school fired with a zeal for truth, confess to them how little you know compared with what remains to be known, apprize them that there is not a subject to which they can apply themselves where new materials are not wanted to advance the fabric or secure the foundations, let them see that the more multiplied have been your discoveries, the more additional openings to discovery have appeared; and if you will then draw the pencil line of what is, and what is not, made out in every science, if you will indicate to them those prominent points and *inlets* of inquiry which bid fair to lead to promising results; if you will thus put before them right subjects, and at the same time suggest the right method of treating those subjects; whatever more may be wanting to accurate and successful investigation, natural sagacity and a longer experience will easily supply to men possessing only common abilities, and walking in the common paths of life."

We feel that we should discharge but imperfectly our duty in disseminating as widely as possible the objects of this report, did we not transfer to our pages the recommendations of the sub-committees of the association upon different branches of science, who are in fact the active organs of the association, forwarding its scientific objects, and providing the intellectual occupation of its successive meetings.

[*Brewster's Journal.*

¶ *On the use of Heated Air and Uncoked Coal in the Smelting of Iron Ores.*

The journals have lately announced the discovery in France of a method of smelting iron ore with billets of wood uncoked, from which a great saving of expense is anticipated. This discovery will prove of high value to the iron smelters in foreign countries, especially in the north of Europe. But to the British smelters it is vastly inferior

in importance to the process now employed at the Clyde Iron Works, by which iron of an excellent quality is obtained at once, and in much larger quantity than formerly, by the employment of raw uncoked coal. The agent in this remarkable amelioration of the smelting process is heated air, with which the blast in the furnace is kept up instead of the cold air hitherto propelled into the furnace. The iron, when withdrawn, is much more fluid than when smelted by the old process, and in this respect has much resemblance to the Silesian iron of the first fusion. The value of this happy application, in an economical point of view, may be seen from the following circular drawn up by the patentee.

Comparative view of the quantity of materials required at Clyde Iron Works to smelt a ton of foundry pig iron, and of the quantity of foundry pig iron smelted from each furnace weekly:

	Coals in tons of 20 cwt., each cwt. 112 lbs.	Iron-stone.	Lime-stone.	Weekly produce in pig iron.
1. With an air not heated and coke, - -	7 tons	3¼	15 cwt.	45 tons.
2. With air heated and coke, - - - - -	4¾	3¼	10	60
3. With air heated and coals not coked, - -	2¼	3¼	7½	65

Notes.—1st. To the coals stated in the 2d and 3d line, there will fall to be added 5 cwt. of small coals, that being required to heat the air.

2nd. The expense of the apparatus for applying the heated air will be from £200 to £300 per furnace.

3d. No coals are now coked at Clyde Iron Works; at all the three furnaces the iron is smelted with coals.

4th. The three furnaces are blown by a double powered steam engine, with a steam cylinder forty inches in diameter, and a blowing cylinder eighty inches in diameter, which compresses the air so as to carry two and a half pounds per square inch. There are two tuyeres to each furnace. The muzzles of the blow pipes are three and one-eighth inches in diameter.

5th. The air is heated to upwards of 600° of Fah. It will melt lead at the distance of three inches from the orifice through which it issues from the pipe.

[*Brewster's Jour. of Sci. No.* 12, *April*, 1832.

On the Manufacture of Sulphuric Ether.—C. Wittstock.

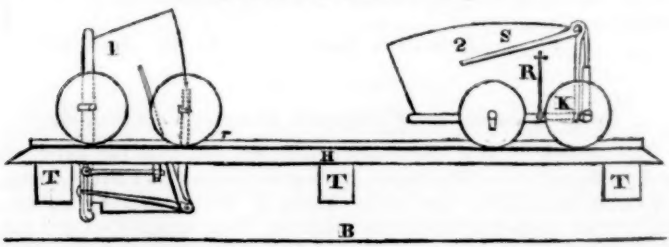
The remark of MM. Fourcroy and Vauquelin, that the sulphuric acid employed in the fabrication of ether undergoes very little change, led to the conclusion that ether would be formed as long as there was a fresh supply of alcohol to the acid. This supposition was confirmed by the experiments of M. Gay Lussac; and since then the fabrication of ether has been considerably improved by MM. Boullay, Geizer, and others. I have for some time employed the following

method; and as I am disposed to consider it more simple and less expensive than any other, a short description of it may perhaps be acceptable to the reader.

A mixture of nine parts of sulphuric acid, (s. g. 1.84—1.85,) and five parts of alcohol, (s. g. 0.835,) are put into a green glass retort of one foot in diameter, with a glass tube inserted at its upper part. This tube is four lines in diameter, and bent at a right angle; the shorter arm, which at its extremity, has only one line in diameter, is plunged one inch deep in the mixture; the longer arm, of about three or four feet length, with a cock near its further end, leads into a bottle, with alcohol. The receiver consists of a refrigerator, viz. a wooden tube filled with water, by which the distilled ether is kept cool, and two copper vessels, the one within the other, so that there is a distance of about two inches between their sides. The neck of the retort leads into the intermediate space between the two copper vessels, which is thus filled with the distilled liquid, and from which the liquid may flow off by another tube. The apparatus is used in the following manner:—When the mixture is boiling, the cock of the glass tube is opened, and the supply of alcohol thus kept up, so that the quantity of liquid in the retort remains always the same; this is continued until eight times the original quantity of alcohol has been used, which will be the case in about twenty hours, if the original mixture consisted of 25 lbs. of sulphuric acid, and 14 lbs. of alcohol. The first rectification of the ether thus obtained yields about its third of ether of .725 sp. gr. which may of course be considerably increased by repeated rectifications, besides about twenty to twenty-five per cent. of alcohol are regained, which may be subsequently used again, particularly for the supply of alcohol to the mixture.

Of 124 lbs. of alcohol of 0.835 sp. gr., 22 lbs. were regained; the quantity of pure ether of 0.720 to 0.725 sp. gr. at 14° R. amounted to 59 lbs., and of sulphuric acid 25 lbs. were used. The expenses of fuel, apparatus, attendance, &c. does not raise the price of the ether to more than twice that of its weight of alcohol.*

¶ *Improved Excavator's Wagon.*



Sir,—The accompanying sketches represent an improved sort of wagon, which was used for removing the earth at the excavation of

* Extracted from Poggendorff's Ann., Band xx. St. 2, page 461.

the new entrance to the London Docks. It is a well known fact, that if clay is mixed with water and a little sand, it forms so compact and cohesive a mass, that when carted to a distance of two or three hundred yards, it is next to impossible to uncart it without the help of pickaxe and shovel. The soil to be excavated in the present instance being very much of this description, it was the general opinion that the ordinary kind of excavator's wagon would be of little use; and being in the employment of the contractor for the work, I therefore set about contriving such an alteration in the construction as might meet the difficulty of the case. After several trials, with different models, the one of which I now send you a description was found the most suitable. We had a good many wagons constructed on this plan; and I was very happy to find, that when the mode of using them came to be understood by the workmen, they answered our purpose admirably.

Description.

Fig. 1 is a side-view of the wagon when emptying. B, shows the line of the barge at high-water. TTT, are whole timbers. H, are half-timbers on each side of the wagon to secure the iron rail, *r*. The distances from TT, and also between the rails, are left open, to allow the tail of the wagon to drop through, as in fig. 1.

Fig. 2 shows the method of securing the tail-board at top and bottom. At J is a joint, to allow the wheels to run out, and at K a catch to secure the axle; *s*, is a strap, bolted to the side to secure the tail-board at the top.

The course followed on emptying the wagons was to push them forward to one of the timbers, as at T, and then to allow the bottom to slide down the timber gently. A man on each side then pulled up the rods, as at R, which lowered the catch K, when immediately the wheels went out, down went the wagon, and the earth dropped out. Nine times out of ten the clayey mass went down into the barge as solid as if it never had been dug. I had almost forgotten to add, that the wagons were about four inches wider at the tail than at the head. The drawings show the axles bent, but they were not all so; the more bent, however, the axles are, the more easily the wagons are managed.

Yours, &c. J. Walker.

[*Mech. Mag.*

The effectual consumption of Coal Smoke, and a mode of erecting Fire-proof Dwellings, without the use of Iron Beams.

To the Editor of the London Morning Chronicle.

Sir,—In your paper of to-day I observe a paragraph which goes to prove, from M. D'Arcet's observation, that the air of the metropolis is contaminated by sulphuric acid. This will always be more or less the case while open fires are employed; but a description of furnace (Witty's,) has recently been invented, which, in all close fire-places, such as stoves for cooking by ovens, or by hot plates, in

the French manner for heating rooms; or furnaces for heating water, producing steam, &c.; in short, in any case excepting where fires in open grates are indispensable, completely burns the smoke. So many inventions for this purpose have been produced and failed, or have acted only partially, that I should have hesitated to mention the present one, if I could not refer your readers to Lee's Nursery, Hammersmith, and Henderson's Nursery, Edgware road, where Witty's furnaces may be seen in operation, and where they will be found completely to verify my assertion, by burning the whole of the smoke produced from the fuel. Were these furnaces used in all cases of close fires in the metropolis, it is evident that the quantity of sulphuric acid in the atmosphere would be materially diminished.

But there is a great ulterior advantage which will, sooner or later, result from these furnaces, and which their inventor probably never contemplated. That is, that every family employing one of them for heating a room, for boiling water, for close cooking, for heating a green-house, or for any similar purpose, may produce in them as much coke from common coal as will serve to supply their open fires, and thus these also will produce no smoke, not even when first lighted. Here then is a very simple, economical, and effectual mode, alike applicable to rich and poor, of getting rid entirely of the coal smoke of the metropolis, and of every other town in the empire. Here also are the means suggested of putting an end to climbing boys and smoky chimneys.

Supposing, however, that there were some private or poor families who did not, or could not, afford to prepare their own coke, or who did not use a close fire sufficiently often to prepare enough, there would, no doubt, be others who might prepare more than enough, and sell it; because it is proved that in this preparation 30 per cent. of the fuel is saved which in open fires and common furnaces is lost.

I hope that when government have their more weighty matters arranged, they will appoint a committee to examine how far it may be adviseable to compel the use of this invention, or preclude the use of all coal not coked. This would render the air of our cities and towns as free from smoke as that of the towns on the continent.

While on the subject of general improvement, I may mention another invention, which I consider of very great importance, viz. a mode of building fire-proof houses of any size without the use of iron or any other metal, as durable as stone or brick, and cheaper than buildings composed of the usual materials.

The inventor is Mr. Frost, 6, Bankside, Southwark, near the bridge, where a small house, illustrative of his invention, may be seen, or at least was seen there by me some months ago.

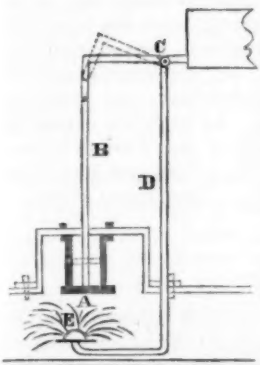
I enclose proofs of some paragraphs which I had prepared on both these inventions for the Gardiner's Magazine, and for an intended work on Labourer's Cottages, which you may use, or not, as you please.

I am, Sir, your most obedient servant,

J. C. Loudon.

Bayswater, January 19, 1832.

Quick-acting Safety-Valve for Steam Boilers.



Sir,—Having had frequent occasion to observe a repugnance to the employment of steam for heating buildings, &c., on account of the risk of accidents from explosion; and as many accidents have actually occurred from this cause, I send you a description of a quick-acting safety apparatus, which I shall be glad to see inserted in your valuable publication.

Yours, &c. Dunbar.

London, Feb. 24, 1832.

Explanation of the Engraving.

When the steam issuing from the boiler, through negligence or other means, gets above any required pressure, (which may be regulated by the loading of the piston,) it acts more or less according to its force upon the piston A, which raises the rod B, and opens the cock C; the water then flows from the cock through the pipe D, and is dispersed in a shower by the rose E fixed on its end, which causes an immediate condensation. The condensed water flows into the boiler, and causes a reduction of temperature. The overplus of water which flows into the boiler, may be let out by means of a float connected with a cock.

This apparatus may be fixed in any convenient part of the piping, by screwing the box on to the pipe, as shown in the sketch. And it is not subject to sticking as the common valves are, (of which there was lately a melancholy instance at Newcastle,) as it will be almost continually on the *qui vive*. D.

[*Mech. Mag.*

¶ *Steam-Boiler Explosion.*

On Thursday, the 22nd of March, the extensive calender house of Messrs. Goodier and Co. of Manchester, was almost entirely demolished by the explosion of a steam-boiler, five persons killed, and many others severely wounded. On the forenoon of that day, the engineer discovered that the eccentric motion which worked the steam-valves had sustained some injury; a millwright was set to repair it; but as it was expected the repair would be completed in the course of the afternoon, moderate fires were kept under the boilers, and the steam kept up. The works were driven principally by an engine of 32-horse power, not a high-pressure one, but a condensing-engine of the best kind, made by Boulton and Watt; and it was worked at a pressure never exceeding 12 lbs. on the square inch. It was supplied with steam from two twenty horse boilers, which were placed side by side transversely across the cellar of the building. The safety valve is stated to have been five inches in diameter, and to have been loaded with 224 lbs. being about ten pounds to the

square inch. But it seems there were no safety valves on the boilers themselves, but one upon a large pipe which conveyed the steam to the cylinder. Between that pipe and the boiler were stop cocks, so that each boiler could at pleasure be shut off from the pipe. It is supposed that one or both of the boilers had been thus shut off, for the convenience of making the repairs. If so, the steam could not act upon the safety valve, and the pressure becoming too great, an explosion was the necessary consequence. In 1828, an explosion took place from this very cause at the factory of Mr. Thomas Kearsley, at Tryldesley, by which ten persons were killed, and great part of a new and extensive building demolished. [*Manchester Paper.*

Manufacture of Salt.

Sir,—I beg leave to intrude upon your valuable columns, by presenting your readers with some observations on the manufacture of salt, part of which I have transcribed from a French work, written by M. Berthier.

The salt works at Moutiers, (in the department of Mont-Blanc,) have four graduation houses, with faggots in the usual manner, and a fifth with rope: which method was invented some time back, by Chevalier Dubuet. These buildings are erected in a narrow pass into a valley. The rope graduation house is built in the form of a crescent, in order to favour the action of the wind: it is ninety yards long, of which only seventy are occupied by the ropes. The top of the building contains 259 wooden channels, thirteen yards long and five inches wide, and having the same distance between them. Each of these channels is furnished with twenty-three endless ropes, 0.007 to 0.008 metres (.3 inch) diameter, which pass through holes made in the channels, and round pulleys fixed to the floor of the building. As each of these endless ropes is 8.28 met. long, the building took upwards of 100,000 met. (sixty miles) of rope, when it was originally constructed. The salt water is raised to the top of the building by an endless chain of buckets.

The salt water is first passed twice through two common graduating houses, with faggots, and then the two portions being united together, the liquid is passed seven times, or even oftener, through the third, from whence they pass to the fourth. The remainder of the process differs according to the weather.

During the fine season, which lasts three or four months, the liquid is passed from the fourth house to the boilers, and from thence when it boils to the rope graduating house, where it is repeatedly raised, until the greater part of the salt is deposited upon the ropes, which in very fine weather takes from twelve to sixteen hours. In general twenty-seven boilings take forty-five days.

The cords are then coated with common salt, so as to be sometimes 0.06 (2.3 in.) in diameter; this salt is got off by a cross piece of wood, armed with iron plates, being raised to the top of the building, and the cords pulled alternately, so as to strike the salt

against the plates. In the bad season the water is slowly evaporated in the boilers, of which there are four, all of the same size; they are from between seven and eight metres long, five and six broad, and 0.5 met. (19.6 in.) deep.

Yours, &c.

Oct. 21, 1831. H. B. Andrews.

[*Mech. Mag.*

Œnometer, or Alcohometer. By M. Emile Tabarie.

This instrument is intended to supply the manufacturer with the means of ascertaining the quantity of spirit in any vinous liquid. The principle consists in boiling the wine, for instance, in the open air, allowing the alcohol to escape, and making up the bulk of the residue by the addition of pure water. The difference between the density of this mixture and the original liquid indicates the quantity of alcohol which was present. The apparatus consists of a small boiler heated by a spirit lamp; a horizontal cross bar near the bottom, when left uncovered by the liquid, indicates when the ebullition has proceeded so far as to insure dissipation of all the alcohol. The densities before and after ebullition are ascertained by a hydrometer with a double scale. For correction of temperature, a thermometer with double scale is used, one scale being the centigrade, and the other a peculiar division, intended to simplify the operation. Tables accompany the instrument. The whole is intended for the distillers of the centre of France, and costs about forty francs.

[*Ann. de Chimie, xlv.* 222.

Engraving in Stereotype.

A substitute for wood engraving has lately been devised by a young artist, which, if half the sanguine expectations of its inventor should ever be realized, will totally supersede the present method. The process, the idea of which has evidently been taken from the stereotyping of letterpress, is, as far as hitherto developed, as follows:—A smooth and level plate of metal is covered with a thickness equal to that of the projecting part of type of any ductile composition which will bear heat; what the inventor proposes to use he does not divulge, but it is believed that many sorts of potter's clay will answer the purpose. While this is in a soft state, the design is, as it were, etched with a sharp instrument, care being taken that every line shall penetrate through the layer of composition to the surface of the plate. The great advantages here are, that the engraver has a much more easily worked material than boxwood to operate upon; that the design is cut *into* the material, as in copper-plate engraving, instead of having to be left in high relief, which is an elaborate and dilatory process; and that it is executed without the necessity of *reversing the design*, a point of great importance, especially where letters and inscriptions are required; these, of course, had always to be

cut the backward way; by this method they are cut just the same way as they are to appear finally upon the paper. When this portion of the process is finished, all that remains is to harden the composition, and take off a plate, or any number of plates, in stereotype metal, in the same way as if it were the plaster impression from a page of letter-press. These, of course, are to be printed from in the usual manner. Should the project succeed, the cost of engravings of the kind will be very greatly reduced. [*Mech. Mag.*

On a new Anemometer.—By Hugh Hamell.

To the Editors of the Philosophical Magazine and Annals.

GENTLEMEN,

Mr. Stevenson in his account of the erection of the Bell Rock light-house observes, "We cannot enough regret the want of an efficient anemometer, or instrument for measuring the force of the wind; indeed we hardly know any desideratum of more universal interest." It does not appear that this is yet supplied: and when we consider the many very eminent men who have directed their attention to this subject, and find nevertheless that they have not succeeded in producing an instrument at once ready, accurate, and sensible, it must be concluded that considerable difficulty lies in the way. And though I will not presume to say that I have completely overcome it, yet it appears to me that the instrument which I now propose possesses advantages over any other anemometer that I have seen or read of.

Before describing the instrument, I wish to observe that all the anemometers I am acquainted with are founded on one or other of these two principles: the deflection of a pendulous weight, or of a falling body, from the perpendicular; or the difference in elevation between the two columns of fluid in an inverted siphon. Of this last kind, the differential barometer of the late Dr. Wollaston, surpasses in sensibility to an indefinite degree, all others of the kind,—an invention worthy of the accurate and comprehensive mind of that lamented philosopher; but it is to be apprehended that in many cases it cannot be easily applied to practice.* It is the other principle, that of a pendulous weight deflected, that I make use of; and I shall now proceed to the description of the instrument I propose.

Imagine two pieces, which I shall call bars, like the two ruler pieces of the common parallel rule, and attached to each other by two joints in a similar manner; the joints being constructed so as to play with scarcely any friction. Let these bars be placed, in contact, with the plane of the joints perpendicular to the horizon; it is clear that the weight of the lower bar will cause it to separate from the upper; and the joints to arrange themselves perpendicular to the horizon. To one end of the lower bar (that end which is to be pre-

* A notice of Dr. Wollaston's paper on his Differential Barometer, will be found in this Journal, p. 349, vol. iv.

sented to the wind,) let a plane of given magnitude be affixed, perpendicular to that bar. Now, to use the instrument, let this plane be placed perpendicular to the wind, the upper bar being in a fixed position; the two bars being separated to their greatest distance, and the joints of course at right angles to the bars, and perpendicular to the horizon. The impulse of the wind acts as a force on the plane, and causes it to recede; but in consequence of the two connecting links, and the two parallel bars, it must still preserve its parallelism to its first position, while it will continue to recede; the links turning round their centres until they have reached such an angle from the perpendicular as shall produce an equilibrium between the impulse of the wind on the plane and the weight of the lower bar with its appendages, now supported by the links in an oblique position; the angle by which the links deviate from the perpendicular to be measured on a circular arc attached to the fixed bar. As the lower bar, plane, and links ought to be made as light as is consistent with the required strength, and further, perhaps, their common centre of gravity to be brought by counterpoise into the line joining the upper centres of the links, it will be seen that the most moderate breeze will cause the two bars to collapse, or nearly so. There must, therefore, be a series of weights, one or more of which must be suspended to the lower bar according to the strength of the wind, so as to cause the equilibrium to take place with the links at an angle not greater than 45°, from their quiescent or perpendicular position.

Now the weight deflected is known, the surface of the plane is known, and also the angle passed through by the links; hence, by an easy calculation, the force acting on the surface of the plane is readily deduced; and from this the velocity of the wind, by means of the tables published of the relation between that and the force.

I hope I have made my ideas sufficiently clear without encumbering your valuable pages with a sketch, or with the details of construction. And for the same reason I shall not make any comparisons between this and other anemometers, except that I conceive the suspended sphere, as it always presents an equal and similar surface to the wind, makes a very simple anemometer, and by counterpoising as I have done, it might be rendered sensible to almost any degree; but I think it is liable to objections, from which I believe that which I propose to be free.

I shall feel obliged if you will give insertion to this paper in your extensively read and valuable journal; my object being to assist in attaining that desideratum which would be of such advantage in many cases of practical mechanics, as well as in meteorological observations.

I am, gentlemen, your obedient servant,

Dublin, Oct. 28, 1881. HUGH HAMELL.

[*Phil. Mag.*

Indian Arts and Manufactures.

No. II.*

The Palm or Toddy Tree.

The most extensively useful tree in India, and probably in the world, is the palm tree. In India I have only observed four species. 1st. the *cocos nucifera*, or cocoa-nut tree, which is common all along the western coast, near the sea, as far north as Surat—some are found even more to the northward. 2ndly. the *bonassus flabelliformis*, which the natives call the "tar," is also in great numbers as far up as Cutch; I have myself seen it 130 miles from the sea; but I believe it is to be found at a much greater distance. 3dly. the *phœnix dactylifera*, or date palm, is common all the way up the coast from Cape Cormorin to Cutch, and is found several miles inland. 4thly. the *areca*, which is cultivated only on account of the nut, is found in gardens in Bombay, Baroda, &c. &c.

Every part of the cocoa-nut tree is used for some purpose or other. The nut is well known, and is not only an indispensable ingredient in every article of native cookery, curries, pilaws, &c.: but yields by expression (when dried,) an oil which is superior to linseed oil for burning, both as having less smell, and producing in the combustion no visible smoke. The natives also anoint themseves all over with it. The shells of the cocoa-nut, when burnt to charcoal and pounded, are used in paint, like lamp-black in England. The hard, or inner shell of the nut, forms their drinking cups, as well as a material part of their smoaking apparatus: half full of water, with two hollow bamboos fitted into as many holes bored in it, and an earthen "chilum" at the top full of tobacco, it forms their "hukka," a companion which no native would willingly be without. The outer shell consists of a stringy substance called "coir," pronounced "kyar." It is equal to horse hair for stuffing mattresses, pillows, &c., and when formed into ropes is in some respects equal, and in others superior to hempen cordage, being much lighter, more elastic, and not so likely to be damaged by wet. The leaves of this, as well as of the "tar" tree, when dried and platted, are called "cajan," and are used for laying under the thatch of houses, by which a much smaller quantity of grass will suffice. They are sometimes used without grass, but then require to be renewed annually. The body of the tree is of much service, when hollowed out, as a course to conduct water across a road, or "nulla" (the dry bed of a rivulet, or mountain torrent,) for the purpose of irrigating lands at a distance from the well, or tank, from whence the water is drawn. But to the owner of the property the most valuable part of the palm tree is the toddy. The best and sweetest is extracted from the date palm; the cocoa-nut tree yields the next best, which,

* The great distance of the writer of these valuable papers from England, will account for his communications being so "far between." No. 1 appeared in our 14th vol. p. 387. We need not say that an early continuation of the series will be most acceptable.—*Editor Mech. Mag.*

however, as well as that obtained from the "tar," or fan-leaf palm, (as I believe it is called,) is more abundant than the former; it is never taken from the areca. This liquor is thus obtained. At sunset, a man of the Bundarree caste of Hindoos mounts the tree with two or three earthen pots, called "chatty," capable of containing about a gallon each, tied to his waist, and a large knife, shaped like a sickle, in his hand. He is assisted in his mounting by two circular pieces of rope, large enough to extend round (when doubled) two-thirds of the circumference of the tree, one of them being attached to his hand, and the other to his feet, by which means he ascends the tree without the assistance of his knees. Some of these trees, I should guess, are above 100 feet in height; and one man has twice daily to ascend and descend some fourteen or fifteen, or even more of them. He cuts off one of the leaves of the tree when the stalk is about two inches in diameter, and ties on one of these chatty pots. If the leaf has before been cut off for the extraction of the toddy, he only removes half an inch from the end of the stalk, whence the toddy again exudes. After having thus fixed his pots, sometimes three or four on one tree, he descends the tree, and mounts as many more as may be necessary. In the morning, at daybreak, he returns to the trees, takes down the pots, which are half full of liquor, and places others in their stead. This liquor, which, when fresh from the tree, is called "neera," is as transparent as water, and of a pleasant, sweet taste; but immediately the sun rises, it begins to ferment, after which it becomes of a milky colour, tart, and sourish—it is then termed "taree," whence our corruption, toddy. The fermentation is soon at its height, and in that state it is used by our bakers as a substitute for yest to raise the dough. A great deal of the taree is drank by natives, and is of an intoxicating quality; but by far the greater portion is made into vinegar, or distilled into arrack. The European soldiers, and even warrant officers, who are used to it, prefer arrack to brandy or rum, though it is not relished by Europeans on their first arrival. Besides arrack, there is another species of distilled liquor, called "mowrah," which is made from the flowers of a tree of the same name, which grows to about the size of a beech tree. As I have not had an opportunity of examining it, I do not know to what class it belongs, or what its English or Linnæan name may be. The flowers, when dried, have much the appearance of a fig, but are only about the size of a raisin; and their taste is somewhat like the latter, with a bitter flavour exactly like hops; and I have no doubt that when we shall have proceeded to so high a degree of refinement in this country as to brew our own "Hodgson," that they will fully answer every purpose of the latter.

BENGEIN.

Goozerat, Oct. 28, 1830.

[*Mech. Mag.*

On the Discharge of a Jet of Water under Mercury.
By R. W. Fox, Esq.

Having observed that a communication of mine "on the discharge of a jet of water under water," inserted in No. 47 of the Philosophical Magazine, has been noticed in the last number of the Journal of the Royal Institution,* I will take this opportunity of mentioning, that where a jet of water is discharged under mercury, the results are the same, under a given force, as when it takes place in water, or air, the quantity discharged being in all cases the same, in the same time.

Hence, it appears that the force with which a moving or spouting fluid recoils is not affected by the surrounding medium, however rare or dense it may be: and thus we may understand why the attempts which have been made to propel vessels by forcing water through them against water, have not proved advantageous.

The well known fact that large rivers penetrate, in a direct course, far into the ocean, notwithstanding its agitation by tides and currents, is somewhat analogous; and were it not for this remarkable degree of mobility in water, the sediment, which is now mostly deposited at a considerable distance in the sea, would accumulate near the mouths of rivers, and tend to divert them from their course.

Whilst making my experiments on the jet of water, I noticed that when sand was dropped into the water near the orifice from which the jet issued, it was drawn laterally toward the hole, till it distinctly appeared to enter it, but it was in fact only an optical deception, the grains of sand being carried away by the jet as soon as they came in contact with it, with such great velocity as to be perfectly invisible. [*Jour. Roy. Inst.*

Tanning of Leather by Grape Marc.

A medical man of the neighbourhood of Narbonne has announced that the marc of grapes, after being distilled for the purpose of separating the alcohol, is an important assistant to oak bark, in the tanning process. After preparing skins in the usual manner, he placed them in the pits with the marc, in the place of bark. In thirty-five or forty days the tanning was finished. The expected advantages are, 1, shorter time; 2, reduction of the price of oak bark; 3, a more agreeable odour of the leather than that given by oak bark; 4, greater strength in the leather. [*Recueil Industrielle.*

Planting Potatoes whole.

A correspondent of the Gardener's Magazine, No. xxxv. for December, writing upon the above question, agrees with Mr. T. A. Knight in recommending that they should be planted whole: and adds, "as a testimony, I will state an experiment of mine in 1828. I planted four plants containing two eyes to each; four, the crowns

* See vol. viii. p. 69, of this Journal.

containing perhaps five or six eyes each; four small whole potatoes, (what are here termed chats;) four large whole ones, (or what are termed ware potatoes.) Now for the weight of the produce of each kind: the produce of the first four roots weighed eight pounds; that of the second four, eleven pounds; that of the third four, fifteen pounds; that of the fourth four, sixteen pounds. I think this will make clear to any one, that the reverse of what is generally followed ought to be practised; namely, to plant crowns or whole potatoes in lieu of a plant with two eyes. This is even the second trial I have made, and found it the same; but I was not so particular in the first experiment as in the second, having determined by my eye, the difference was so obvious. I think this of the greatest importance to the agriculturist. If it hold good for an acre, what a difference in the produce! The object of a little extra seed bears no comparison to the extra produce; and besides, the labour of cutting is saved.

[*Rep. Pat. Inv.*

Pure Oil for Chronometers.

Put about one gallon of good olive oil into a cast iron vessel capable of holding two gallons; place it for one hour over a slow clear fire, keeping a thermometer suspended in it; and when the temperature rises to 220° check the heat, never allowing it to exceed 230°, nor descend below 212°; at the end of the hour the whole of the water and acetic acid will be evaporated. The oil is then to be exposed to a temperature of 30° to 36° for two or three days, till a considerable portion of it is congealed, and while in this state the whole is to be poured on a muslin filter, to allow the fluid portion to run through. This fluid portion is then to be filtered once, or oftener, through newly prepared animal charcoal, grossly powdered, or rather broken, and placed on bibulous paper, in a wire frame, within a funnel; by this operation any rancidity that is present will be entirely removed, and the oil rendered perfectly bright and colourless. This process has been employed for several years with great success by Mr. Henry Wilkinson, of Pall Mall, and Messrs. Baraud and Sons, of Cornhill, who both agree in representing it as superior to every other mode of purification hitherto known. Mr. Wilkinson states that he does "not think it possible to render oil purer or better qualified for the required purposes, as no extraneous substance is introduced which can in the slightest degree injure its quality."

[*Mech. Mag.*

¶ *On the Detection of the Traces of Writing Fraudulently Effaced.*

Professor Gazziri, of Florence, having been frequently appointed by the tribunals to give professional evidence on trials of this nature instituted experiments on the subject, which, by showing him the possibility of removing not only the ink, but also the materials employed in its removal, proving that cases might arise when the fraud

could not be detected in any other manner than by examining the condition of the paper or other materials written upon. For this purpose optical means were tried in vain, and immersion in water did not show such a difference in the absorptive power of the written and unwritten parts, as happen in the employment of certain sympathetic inks; but on exposure of the suspected paper to a moderate fire, the paper, which in consequence of the corrosive effects of the ink, was in those parts altered in its nature, was unequally acted on by the process of carbonization, and thus the number and length of the lines, and often the whole of the erased portion, were distinctly revealed. [*First Report of British Asso. for Advanc. of Science.*

Meteorological Observations for June, 1832.

Moon. Days.		Therm. Sun rise	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches				Inches.	
☽	1	52°	73°	29.70	29.75	45	NW.	Moderate.		Clear day.
	2	50	80	.73	.65	49	NE. W.	do.	.26	Clear day.
	3	56	74	.50	.62	56	E.	do.		Cloudy—rain.
	4	48	69	.50	.45	53	E. S.	do.		Cloudy day.
	5	49	59	.50	.60	54	E. S.	do.	.35	Cloudy day.
	6	48	62	.60	.65	54	SE.	do.		Rain.
	7	50	69	.70	.70	53	W.	do.	.04	Rain.
	8	51	74	.75	.75	55	W. E.	do.		Lightly cl'dy: flying cl'ds.
	9	51	69	.70	.80	57	E. SE.	do.		Cloudy—light shower.
	10	56	74	.90	.90	57	E. SE.	do.		Fog—clear.
	11	60	80	.90	.90	56	NE. SW.	do.	.03	Foggy: clear: shower n't.
	12	60	80	.90	.90	60	SW.	do.		Cloudy—flying clouds.
☉	13	60	80	30.00	30.00	66	SE. W.	Breeze.		Fog—clear.
	14	62	81	29.90	29.90	65	S.	do.		Clear day.
	15	67	82	.90	.90	63	E. S.	Calm.		Cloudy—clear.
	16	62	82	.90	.70	65	SW.	Breeze.	.08	Fog—clear.
	17	60	80	.90	.70	62	W.	do.		Fog—cl'dy: thund. sh'w'r.
	18	62	80	.90	.70	67	W. SW.	do.		Fog—clear.
	19	64	80	.90	.70	64	WNW. W.	do.	.20	Hazy—clear.
	20	69	82	.90	.63	63	W.	Blustering.		Light cl'ds: thund. sh'wr.
	21	69	82	.90	.70	49	W.	Breeze.		Flying clouds.
☾	22	57	84	30.05	30.10	42	W.	do.		Clear day.
	23	58	84	.10	.90	49	W.	do.		Clear day.
	24	63	86	.14	.10	52	W.	do.		Clear day.
	25	63	86	29.94	29.94	51	W.	do.		Light clouds—clear.
	26	62	88	.94	30.00	55	SW.	Calm.		Clear day. [realis.
	27	64	90	.94	29.94	52	SW.	do.		Clear day. Aurora Bo.
	28	63	86	.70	.90	62	SW.	Breeze.		Light cl'ds—flying. cl'ds.
	29	57	86	.70	.75	67	E.	do.	.04	Cloudy day.
	30	61	83	30.00	30.10	63	W.	do.		Light rain—flying clouds.
				.10	.10	47	NW.	do.		Clear day.
						55	SW.	do.		Clear day.
Mean		59.77	79.33	29.82	29.83	58			1.90	

	Thermometer.	Barometer.
Maximum height during the month,	92. on 15th.	30.20 on 21st.
Minimum do. . .	48. on 4th & 6th.	29.50 on 3d and 4th.
Mean do. . .	69.55 . .	29.82